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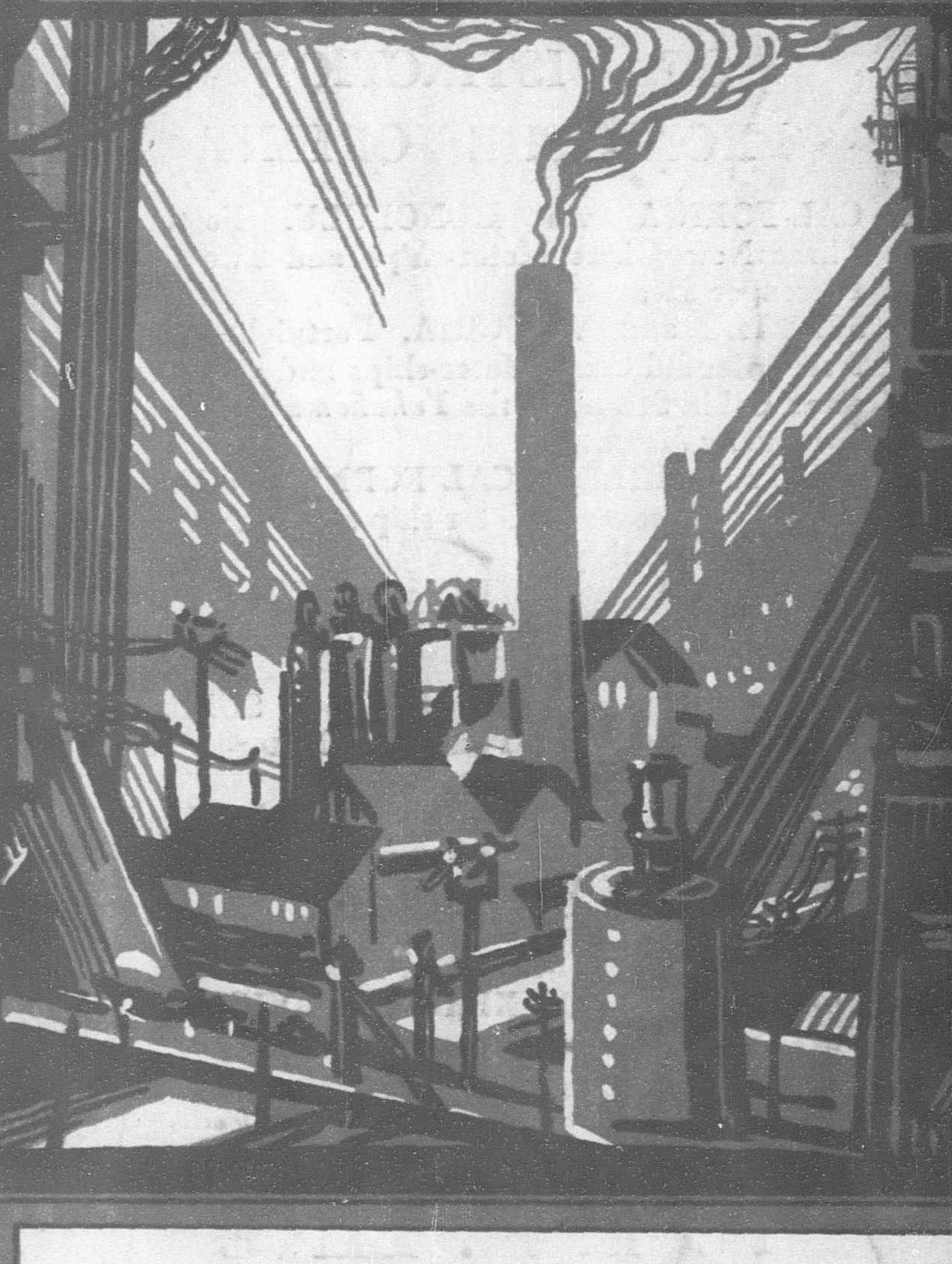

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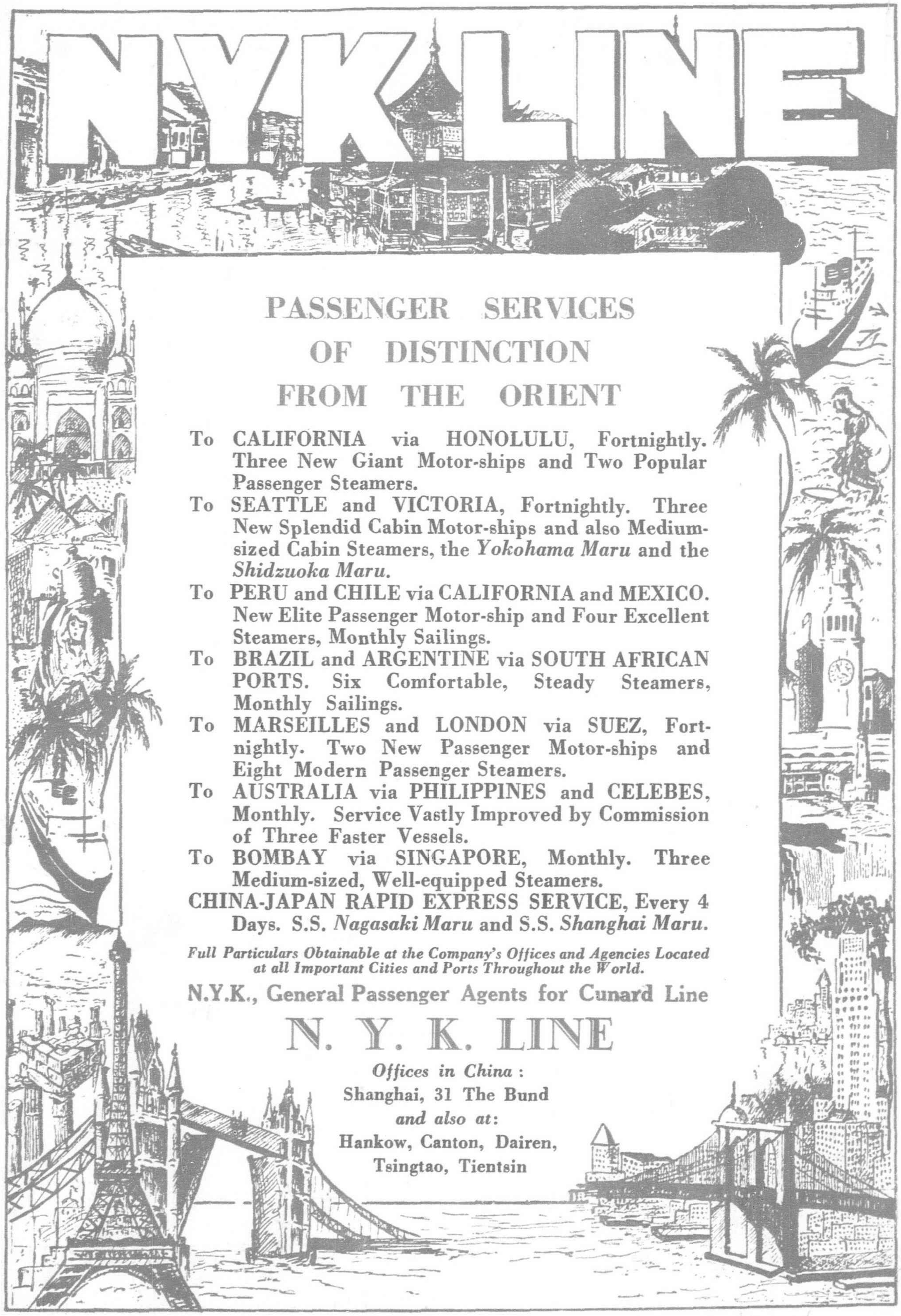

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXVI SHANGHAI, DECEMBER, 1930 No. 12

Chickens Come Home to Roost!

Extraterritoriality and the Industrial Development of China

FOREWORD :—We reproduce below the speech delivered by Minister Sun Fo at the Memorial Service of the State Council on December 15, in which, after an able presentation of economic conditions and the urgent necessity of developing the resources and markets of China in order to relieve the world-wide business depression, he leads up to the conclusion that the abolition of extraterritoriality is essential to the international development of the country. Mr. Sun Fo approaches the issue from a new angle, one that must receive friendly and sympathetic attention from every foreigner interested in the future prosperity of the country, for although the point he makes does not in any way change the political aspects of the problem, it emphasizes a fundamental principle that has hitherto received little attention in the controversy.

In a supplementary interview, Minister Sun Fo explained that the power of initiative in the industrial development of his country has been taken away from the Chinese by the enactment of foreign legislation like the Hongkong Companies Act and the China Trade Act, which create a favored position for enterprises organized under their provisions. These companies are exempted from taxation by their own governments and by reason of their extraterritorial privileges are also exempt from Chinese taxation or regulations.

"There might," he said, be some justification under the old order of things for the establishment of these tax-exempted enterprises where the capital is entirely foreign, but when Chinese capital is invited to co-operate, it constitutes a direct infringement of China's sovereignity. It stands to reason, "Mr. Sun Fo" continued, that under such conditions, the wealth of China would be diverted into foreign registered companies with the power of development initiative taken away from the Chinese authorities.

Here, Mr. Sun Fo touches on a fundamental principle whose violation this publication has condemned as one of the most indefensible encroachments on China's independence. In our April 1928 issue, commenting on the China Trade Act and it's bearing on China's sovereignity, we said :

> "We adhere to our own definition of what constitutes loyalty to American traditions and ideals. We do not always support American policy, when, in our judgment, it is open to fair criticism, *The Far Eastern Review* declined to support the China Trade Act, because we believed it constituted an impairment of China's jurisdiction over her industrial enterprises and power of taxation. We sympathized with American traders in their dilemma, but remained steadfast in our belief that the practice of tax exemption if applied by all other Powers in China, would divert the wealth of the county into these foreign corporations over which the Chinese Government had no jurisdiction. In our mind there was no difference between stealing a Chinese province and stealing the revenues of the nation. Our loyalty to American policies does not extend to a complete surrender of those basic principles on which our own national life is founded."

Mr. Sun Fo's argument carries more weight in the business aspects of the problem than all the political thunderings of Dr. C. T. Wang and his Foreign Office staff. The whole future of China's development is involved in this phase of the question. As long as extrality exists and Chinese capital can hide behind foreign trustees for the organization and administration of companies exempted from all taxation and Chinese official supervision, it will be impossible for the Chinese Government to develop the country or exercise control over its industries.

The Far Eastern Review has consistently opposed the abolition of extraterritoriality on broad general grounds until such time as Nanking can establish its authority, provide adequate protection to foreign lives and properties and put into practice a system of jurisprudence that ensures equality of justice and freedom from oppression. On the other hand, we feel the necessity of some modification of the existing system that will facilitate the investment of foreign capital for the immediate reconstruction of the country and here at the outset, we encounter an almost insurmountable obstacle to the adoption of any intelligent program. The subject is one which calls for further elaboration and constructive comment, but after all is said, the controversy remains just where it is to-day, a vicious circle, coming back to the basic and reasonable objections raised by the Powers to any precipitate revision of the existing treaties until stability is assured and suitable guarantees are forthcoming that China will discharge her obligations.

If China is conceded tariff autonomy as a matter of right, she must also be conceded the power of taxation and control over her public companies, especially, when it is notorious that a large percentage of these foreign registered concerns have been organized by Chinese capitalists using foreign figure-heads in their directorate in order to escape the jurisdiction of their own authorities. We cannot expect any self-respecting Chinese Government to remain content under a system that deprives it of initiative and drives it's own capital to seek the protection of foreign governments.

It might console Mr. Sun Fo and Cabinet colleagues in Nanking to recall that this impairment of their sovereignity, especially as far as the American China Trade Act is concerned, received the full diplomatic support of the old Peking government and it's Minister at Washington and was lobbied through Congress by a very versatile individual who at the present moment is the most voluble champion of China's sovereign rights. Now, when China is desperately in need of American financial assistance, it finds that it's power to carry out the program of Sun Yat-sen and it's control over the development of it's industries and resources, has been alienated through the "imperialistic" activities of a champion, who, according to all reports, is the recognized spokesman of the Ministry of Foreign Affairs. It is something for Minister Sun Fo and his colleagues to ponder over. *"Chickens do come home to Roost!"*—G. B. R.

Industrial Development

A Speech Delivered by Mr. Sun Fo at the Memorial Service of the State Council Monday, December 15, 1930

"The substance of my speech to-day is mainly based on Dr. Sun Yat Sen's Preface to his own book entitled "Industrial Scheme"

written at Canton on October 10, 1921, exactly ten years after the establishment of the Chinese Republic. This brief document bears the closest relation to the economic construction of China. Part of it reads as follows :—

"As soon as the armistice was signed, I began to devote myself to the study of the International Development of China. Six programs for construction were then drawn up. The aim of my study was to utilize the war-time large-scale machinery and organized labor to help China in her industrial development so that she could make long strides in her industrial progress. I had also in view the settlement of post-war employment problem. But unfortunately, the European and American peoples, being so tired of war, suddenly relaxed as soon as the news of Armistice reached them. They wanted to go immediately back to normalcy. Then, not only the soldiers back from the front were gradually disbanded, but factories in the rear also closed down. Although my scheme was supported by a few far-sighted statesmen, the war-time industries could not be retained for China's benefit. On China's part, a golden opportunity was lost. In Europe, economic crisis ensued. It continues. Europe now suffers more than during the war. If Europe desires to return to its pre-war normalcy, she must develop China's rich resources. It is clear then that the development of China's resources have now become the greatest problem of the human race, a problem to be solved not only for China's benefit. If the power of development remains in China's own hand, she will thrive ; otherwise she will perish. It is clear then that in time to come whether China thrives or perishes, depends on her industrial development."

When Dr. Sun was studying the problem of the International Development of China at the end of the European war, he felt that if after the war, Europe and America could not use their machinery and labor to help China develop her industries, the economic problem of the world in general and of China in particular, would be very serious. From the close of the war to the present, economic crises have occurred everywhere. It is becoming more and more serious every day. Does this not illustrate Dr. Sun's far-sightedness ?

Newspapers report that in England the unemployed exceeds 2,000,000. Even in the prosperous United States of America, the number of unemployed exceeds 5,000,000. It may increase to 7,000,000 or more. The total number in the whole world exceeds 17,000,000. Including dependents, the number of people without means of livelihood easily reaches 50,000,000. This all rises out of the economic crisis and the lack of a solution for the unemployment problem. It is surprising to find so many unemployed in such industrially developed countries like those in Europe and America. How could such condition come about ? Because from 1918 on, suffering from the effect of the war, the different peoples have had neither the time nor energy to study the problem. While statesmen, on account of their lack of far-sightedness, devoted their whole attention to the maintenance of their political position and the struggle for temporary power, neglecting the fact that after the war, it is not easy to restore the industries back to normalcy and that without restoring the industries back to normalcy, the number of unemployed is bound to increase. Lack of far-sightedness on the part of the statesmen naturally results in lack of remedies for the situation.

Later, for want of a better solution, the British Liberal Government introduced the dole. The system provides that unemployed laborers, after due process of registration at the Unemployment Bureau, will be given an allowance. This system lays the responsibility of supporting the unemployed on the Government. Since its inauguration in 1918, the number of unemployed has increased and is still increasing and no better substitute is in sight so far. Laborers have become too lazy to look for work as they can live without working. Such a system makes people indolent and unwilling to work.

We all know that the British Empire has large dominions such as Australia, Canada, South Africa etc. All these places are sparsely populated. Why does Great Britain not send the unemployed to these countries ? Because most of the unemployed are factory hands, ignorant of farming. The dominions need farmers, but the unemployed in Great Britain are unfit for agricultural work. Furthermore, they are reluctant to emigrate, because the dole provides them with a livelihood without work, thereby making them indolent. As a consequence, the number of unemployed has now increased to such a magnitude that it looks as if the problem can not be solved at all.

Practically speaking, their unemployment problem cannot be solved until ours has a solution. In other words, if China's industries develop, our standard of living will rise and our purchasing power will increase. Then their products will have a market, their workmen will have employment and the economic crisis in the world will be settled. China's problem is therefore a world problem. We must solve China's problems first before we can hope to solve the world's. Conditions in the various countries are so serious that if China's industries do not develop, it seems that the world's economic crisis can not be settled.

Let us now take the United States of America for example. No doubt, America is the richest country. She is the gold center and controls the gold market. In one of President Hoover's presidential campaign speeches, he said that the United States is a rich country, and would not have to worry about poverty and insufficiency ; that her only problem was how to best utilize her riches for the welfare of the people. But only two years after President Hoover made that statement, the number of unemployed in the United States exceeded 5,000,000, some reports state that it has reached 7,000,000. If this problem is not solved, it means the United States is at her wit's end. It is reported that in New York and Chicago, some people without means of livelihood purposedly commit minor crimes like the breaking of window glass, so that they can be arrested and put in to goal, where they are fed and comfortably housed. To them it is better to be a criminal than suffer from cold and hunger. In every big city, there are hundreds of thousands of unemployed. How can a city or state provide so many prisons ?

Referring again to Dr. Sun's work, we find that nine years ago, our leader clearly stated the problem in the preface of his book "Plans for National Reconstruction." He proposed to utilize the war-time machinery and labor to assist China in her industrial development so that the Chinese could make rapid economic progress and help solve the post-war labor problem in Europe and America. The march of events has now come to prove Dr. Sun's far-sightedness, to his instructions, we can neither add nor subtract. Now the British and American have come to realize the importance of the problem of international development of China. Great Britain is a commercial country. She exports annually a tremendous amount of products, particularly to China. Her exports to China used to rank first, but now they have been relegated to third place, amounting to less than ten per cent of our total imports. This condition certainly causes Great Britain anxiety. But what can they do ? They organized an Economic Mission, to study trade conditions in the Far East. From appearances, they come over to study, yet actually their aim is to work out plans to export more goods to China so their laborers may have employment. In the United States, a Committee to study Sino-American trade was organized in the Senate, to find out why American goods can not sell in China. The result of their study shows that silver depreciation is the cause. Because China has a silver standard, as silver depreciates, China's purchasing power drops, They, therefore, propose to loan to China large quantities of silver bullion as a commodity so that the Chinese can develop their industries and thereby increase their purchasing power and help America to settle her economic crisis. This clearly shows that fundamentally they have to solve China's problem first before they can solve their own.

Recently, foreign newspapers report that Senator Borah, Chairman of the Foreign Relations Committee, made a statement that on account of the economic crisis, the unemployment problem could not be solved ; the only hope lies on the extension of the market and that China and Soviet Russia constituted the only two prospective markets for American goods. Russia however has a five-year Economic Construction Program, which when carried out, will close her markets for foreign goods. America's only hope then is China. But how can China, poor and exhausted, afford to consume foreign products ? How can she help Europe and America to solve their economic problem ?

The only way is to follow Dr. Sun's plan for the International Development of China. If China's industries develop, the world's economic crisis will be automatically settled. When Dr. Sun made his statement, Europe and America had just finished their war, and they paid no attention to his plan. Few people understood his far-sightedness. Although almost ten years have elapsed, his plan remains unexecuted and the world's economic problem remains unsolved. Opportunities for Europe and America to help China

(Continued on page 708)

Cause and Effect

"The Collapse of a Civilization" and "Tortured China." Two Recent Books about China that Fearlessly Diagnose Her Ills and Prescribe a Remedy

TORTURED CHINA: By Hallett Abend, Published by Ives Washburn, New York

CHINA: THE COLLAPSE OF A CIVILIZATION: By Nathaniel Pfeffer, Published by The John Day Company, New York.

Many books have been written about China in an effort to explain the forces underlying an upheaval that in a few short years has wrought more havoc and misery to humanity than the four years of Armageddon. Many of these tomes are worthless propaganda, written for the sole purpose of concealing the facts in order to place the responsibility for what has happened upon other nations. When, for over a decade, the force of this propaganda was directed against Japan, it was accepted at its face value in Europe and America and diverted attention from the crumbling of China's foundations, but as the picture changed and "Imperialistic Britain" and "Capitalistic America" became the target for Chinese ire, independent investigators began to take a greater interest in Asiatic problems. Practically every impartial writer who has studied the situation on the ground arrives at more or less the same general conclusions.

Had the truth about China been told ten years ago much that since has happened would have been averted. Up to 1926, China's publicity was directed by a group of writers subsidized by the Peking Government who by reason of their environment were also intensely antagonistic to the Kuomintang and a parliamentary system of government. The most sturdy partisans of the Pei-Yang military leaders and the most bitter critics and enemies of Dr. Sun Yat-sen were the small group of foreign jounalists who clung to the policies that found expression in the Reorganization Loan of 1913. That loan killed the Chinese Republic, fastened upon the people the old order of things under a different name and made possible the succession of devastating civil wars that has brought ruin to a prosperous nation. The loan was openly repudiated by Dr. Sun Yat-sen and the leaders of Parliament but was forced through over their protest.

With the funds so obtained, Yuan Shih-kai, was seated firmly in power and within a few months, the parliament was dissolved, the Kuomintang leaders proscribed and Dr. Sun Yat-sen forced to seek refuge in Japan. The legality of the loan was constantly menaced by the possibility that the Kuomintang might again come into power and carry out Dr. Sun's threat to repudiate the obligation. It was natural that every British writer and journalist in China should defend the policy that meant so much to their government and investors. An unreasoning, bitter hostility towards Dr. Sun and all that he stood for was the result. The Treaty Port press in China, up to the time of his death had never a good word to say for him. He was derided, defamed, slandered, scoffed at as a professional revolutionary, an agitator, a disturber of the peace, a dangerous character, a visionary and even as a crook. His most violent calumniators were a group of journalists who invented and circulated the stories that went the rounds of the world press, influenced other writers and solidified world opinion to their point of view. Dr. Sun Yat-sen could make no headway against a propaganda inspired by the Peking Government and fortified by the exigencies of international finance. Those few of his friends who supported him, were penalized, boycotted and ostracized by the cabal in power.

When the writer visited him in Canton in the autumn of 1924, Dr. Sun expressed indignation and resentment against this unrelenting personal hostility and declared that if the press campaign against him did not cease, he would retaliate and destroy British trade. The May 1925 incident, may have been the spark that set off the magazine but the train was already laid. It is perhaps just as well that the May incident should stand as the turning point in the history of the Nationalist movement, but to those who know something of the inner workings of Dr. Sun's mind, the real cause of the anti-British explosion and all that followed, including the alliance with Moscow, had its roots in the campaign of derogatory, vicious, unkind and ungenerous journalism against the man whose ascendency to power meant disgrace to those Peking sycophants and place servers who had betrayed him politically and the certainty that those who have been instrumental in knifing the Republic through financial assistance to Yuan Shih-kai, would be punished and the loan repudiated.

Not until the boycott against the British shook the very foundation of their trade and prestige did these writers wake up to their mistake. Then the world was swamped with a flood of explanations. "What's Wrong With China" by Rodney Gilbert; "Why China Sees Red" by Putnam Weale and "The Truth About the Chinese Republic" by H. G. W. Woodhead quickly followed. These books came too late. The damage had been done. Had they been written ten or even five years earlier and backed up by an impartial editorial policy in the Treaty Port newspapers, the public in Great Britian and America would have been better informed and their governments influenced to withdraw recognition to the Pei-Yang militarists and extend some sympathy and moral support to a movement based on an honest endeavor to implant a Liberal or Parliamentary system of government in China. Blind, unreasoning prejudices, paid propaganda and a deliberate concealment of the truth brought its own reward. It is easy enough at this late date for philosophers, political scientists and essayists to sit quietly in their studies or skim hurriedly over the surface of things in China and analyze objectively the causes which have led to the disintegration of China, ignoring facts that at any given moment would have completely changed the course of events and the conclusions arrived at in their writings.

So many basic facts have been concealed that practically every book on China written during the past thirty years is worthless. Most of China's political troubles, her so-called break-up and partition amongst the Powers, the Battle of Concessions, creation of spheres of influence and all the problems that followed as a result of the competition for railway and loan concessions, had their origins in the secret treaty of alliance between China and Russia of 1896, which although preserved a profound secret, was made manifest too openly for other Powers to misunderstand what was going on. With that fact as a start, the accepted version of Far Eastern history must be revised. China's official confession of its existence at Washington in 1921 completely changed the picture but the great mass of books on Far Eastern problems that still stand on the shelves of the world's libraries make no mention of this historical document. Even if they did, there are few men in the world with sufficient knowledge of the international politics bound up in China's railway agreements, competent to piece together what followed, unless they have access to the secret archives of the governments concerned.

At rare intervals, the world is permitted to sense something of the real meaning of these moves, as when Balfour at the Washington Conference enlightened his audience on the mainsprings of Britain's policy when he referred to the Kowloon Lease. Last year at Kyoto, Mr. Y. Matsuoka explained the Japanese attitude towards Manchuria based on the pivotal fact, but it went over the heads of the Chinese and many foreigners who still do not grasp what it all means. The past can be understood only when all the underlying facts are recognized.

As far as the Chinese Republic was concerned, it never had a chance. Dr. Sun's manifestos to the world, the declarations of policy, the promise of liberal and parliamentary government and the invitations to international finance to co-operate in the development of the country that poured forth from Nanking in 1911 were sincere, voicing the hope that the Liberal nations of the world would support the new republic. These appeals for sympathy and friendship fell on deaf ears. The Republic was destroyed at its very inception by a world that believed a Strong Man was needed to manage the affairs of China. Once the Reorganization Loan was floated, the Powers concerned were compelled to support their ill-advised diplomacy in order to protect their investors.

For decades it had been patent that the Manchus were corrupt, inept, effete and unfit to govern. We knew them all and what they stood for. We had sized up accurately all their officials and the world welcomed any change that would sweep them out and bring China into line with Western ideas. But when the change came and with it a group of high-minded, hopeful but inexperienced enthusiasts at the head of affairs, we spurned them as impractical visionaries and bet our money on the most cynical double-dyed, double crossing traitor of the old régime and applauded while he worked true to style and betrayed the republic he had sworn to defend, kicked out, proscribed, and assassinated his opponents, and elevated himself to a Throne upheld by the bayonets of a military oligarchy, whose power has never been broken. When Yuan Shih-kai died and was succeeded by one after another of his henchmen, we still placed our money on whoever commanded the largest army. We supported Wu Pei-fu and others who loudly bragged that they would unify China by the sword, meaning the elimination of the one element that stood in the way of the complete militarization of the nation. For years, the Powers looked on while the full weight of the Northern armies was concentrated upon destroying what was left of a liberal government in China, and the Treaty Port newspapers cheered when Sun Yat-sen was time and again betrayed by double-crossing knaves who sold their leader for the traditional thirty pieces of silver.

To the pleadings of Dr. Sun to withdraw recognition from Peking and support his government at Canton, the Powers again turned him down. The persistent anti-Sun propaganda over a period of ten or more years had its effect. When Dr. Sun threatened to seize the Customs in Canton in order that Canton's share of the revenues should be paid in to the Canton treasury, the Powers rushed gunboats to the Shameen ready to bombard the city. The writer personally carried a friendly message from the British Admiral at Hongkong to Dr. Sun at Canton, counselling him to proceed slowly and not provoke a show-down. Had the Powers eased up on their policy at that time and permitted this diversion of the Customs Revenues, the situation might yet have been saved. But they stood pat on their original anti-Sun program by insisting on the inviolability of the security for their loans. Again the Powers rejected a Republic and backed the Pei-Yang group of hard-boiled militarists. They drove Dr. Sun into the arms of Moscow and in place of a government modelled on the Western conception of Democracy, they got a Sovietized hybrid and although the dalliance with Moscow has since been broken off, the child of the union is now the National Government of the Republic of China, taking its place in the family of nations as a "democracy."

At any time before 1925, the course of events in China could have been directed by the Powers into channels that would have averted the flood of anti-foreignism that is now sweeping away their last vestiges of prestige, power and privilege in this country. They rejected Sun Yat-sen, and got Lenin, and unless Chiang Kia-shek can stem the tide of communism now sweeping over the interior, there will be another cataclysm that will firmly plant the Red Banner of the Hammer and the Sickle over the most important provinces of China.

Philosophers may see in all this the force of Western mechanical civilization breaking down the older culture of Cathay and arrive at the comforting conclusion that all is for the best and that nothing can be done to stave off the inevitable. Being more practical-minded and with perhaps a more intimate knowledge of basic facts, we prefer to believe that a little common sense on the part of the Powers in dealing with China, would have saved her from the débâcle.

Within the last three years the outside world has come to a better realization of what is the matter with this country. Up to 1927, China had a good press; the sympathy of the world was still with her. She lost it when her advocates combining with the Reds, Pinks and Parlor Bolshevists in America, denied the existence of an alliance between the Kuomintang and Moscow and heralded the northern march of the Nationalist army as a spontaneous nation-wide movement towards the Light of Democracy.

A searching investigation on the part of the American Government and newspaper publishers as to the actual extent of the propaganda that so completely bamboozled public opinion was instituted and the inquiry revealed some interesting facts as to the connection between Nanking and foreign newspaper correspondents. The subsequent intransigent policy of Nanking towards the missionaries, who up to three years ago practically dictated American policy towards this country, estranged the element who in press, platform and pulpit had voiced faith and trust in its program. With a press indignant at being fooled; the religious, educational and philanthropic element disheartened, pessimistic and inarticulate, and a government determined to protect the lives and properties of its citizens, Chinese propaganda in the United States was doomed to failure.

Instead of inviting full publicity and providing facilities for independent observers to ascertain the truth and appealing to their old friends for a continuance of toleration and trust during China's period of travail and agony, Nanking tried to bull-neck its way through and impose its side of the story on the American public. A strict censorship was established; newspapers were banned; their post office facilities taken away and correspondents singled out for deportation. A determined effort was made to muzzle the press and prevent fair criticism and dissemination of the truth; a futile and infantile proceeding. Nanking was particularly incensed against Mr. Hallett Abend (at that time the Peking correspondent of the *New York Times*) for his news dispatches which they claimed were misleading and false. The story is told briefly on the Publisher's cover of Mr. Abend's recent book, "Tortured China."

> "Late in June, 1929, Dr. C. C. Wu, Chinese Minister to the United States, journeyed from Washington to New York to request the *New York Times* to remove their Chinese correspondent, Hallett Abend, because he was saying things about China that were 'maliciously false.' When the *Times* refused his request, his government sent a five-page diplomatic document to the State Department in Washington formally demanding Mr. Abend's deportation. Both the American Government and the *New York Times* made official investigations. The State Department informed the Nanking Government that it could find no basis for its charges. The *New York Times* removed their only other correspondent in China and put Mr. Abend in sole charge."

The investigations which followed could have only one finding. This incident, coming on top of many attempts to discredit other correspondents who were cabling or writing the facts, opened wide the eyes of American newspaper editors to a situation in which they had been wilfully misled for years.

In "Tortured China," Mr. Abend gives us vivid, forceful and accurate picture of conditions in this country and points to a possible solution. Mr. Nathaniel Pfeffer, another equally well qualified newspaper writer, in "China; The Collapse of a Civilization," explains the reasons for China's deplorable condition and tells us why the present chaos or vacuum is unavoidable and leaves us there without any hope for the future, stuck in a morass from which there is no escape.

Both these independent writers arrive at the same conclusions concerning the causes which have brought China to ruin. Mr. Pfeffer gives us what is unquestionably the best analysis of China's ills that has yet been published, by showing how the impact of Western civilization, culture, military power, economic invasion and ideals have torn China from her old foundations, beliefs, traditions, customs and moralities and has left her broken, rudderless, leaderless and on the rocks. Instead of a nation, we find only a people without adequate personnel for leadership. Mr. Pfeffer points out that the old China is dead and can never be resuscitated. The course of events is forging a new China different from its old self and different from the rest of the world. China is now in chaos, or as he prefers to put it, in a vacuum, undergoing the process of being created anew, a process that may take another century or even longer. He leaves the future to a question mark. His historical treatment of the subject and analysis of what has gone before is brilliant if not always accurate as to details.

> "In fine," says Mr. Pfeffer, "there is no China to-day. There are 400,000,000 Chinese and a political entity called China. But that for which the name has stood for 2,000 years or more, that which has been most truly China, which gave the life of its people distinctive form and color and differentiated the race from all others—that is gone. Nor is there anything in its stead. There is neither a civilization nor a society, but a flux, a turmoil and heaving mass. . . . . A government there most certainly is not. That which is recognized by the Powers and claims jurisdiction over all the eighteen provinces—the Nationalist Government at Nanking—is a government in name only.
>
> "Politically China must begin anew. First off there must be peace . . . . Too many leaders remain, each with ambitions for exclusive mastery. Hope for immediate unification is slight. What is more likely is a long period of feudal strife, in which case China will descend lower than in its Dark Ages a few centuries before the time of Christ and again a few centuries after. Or, what is more likely the masses will be goaded to desperation, rise in frantic protest and then rend. In that event, night will descend on half a continent."

Mr. Pfeffer rejects the idea that outside intervention can save the situation. He points out that there has already been a hundred years of intervention and the results have been disastrous enough. To expect to "straighten out" China or "set its house in order" from without is like trying to play traffic policeman to an earthquake. China, in Mr. Pfeffer's opinion, will be left to itself. He points no way out except to leave her alone to flounder around without leadership or even a personnel to serve as the nucleus for governmental direction. He is an optimist, but his optimism looks far into the future. In the meantime, the picture he has so accurately painted is one that must sooner or later compel attention from the outside, for if and when the Chinese begin to rend, other nations will be compelled to take some kind of action, benevolent or otherwise. No picture of China of to-day is complete without painting it on a Red background, for although communism in China may bear no relation to the system implanted in Russia, as long as the leaders and agitators receive material aid and encouragement from Moscow, it cannot be altogether dissociated from the main movement. While the rest of the world looks on and refrains from intervention in the affairs of China, the agents of Moscow are as active to-day as they were when Borodin and his group directed and led the Nationalist hosts to victory. Moscow nurses a grievance against Nanking and will never rest until it has overturned the régime it seated in power. It is a notable fact that when Borodin was directing the victorious march of the Nationalist movement, that the Soviet slogan of "Hands off China" was echoed by every Pink publication in the United States and immense pressure was brought to bear upon the President and State Department to withdraw American warships and refrain from any gesture of intervention.

Russia could intervene in the affairs of China and use the Nationalist movement to forward its own designs to destroy the Capitalist and Imperialist Powers, but Great Britain, Japan or America could make no move to defend themselves without violating the sovereignty of China and incurring the further hostility of a people sloganized into an unreasoning hostility against all foreigners except Russia. The picture has not changed in its essentials and unless Chiang Kia-shek is successful in his present campaign the day may again arrive when Moscow will regain its ascendency and take up the fight where it left off in 1927.

If the other Powers are to make no move to protect themselves by bolstering up Nanking for fear of intervening in the affairs of China, while Moscow is having it all its own way, then there is only one termination to the story. With the picture as we see it and so vividly and brilliantly portrayed by Mr. Pfeffer, we cannot subscribe to his conclusion that it is all for the best, the inevitable working out of forces over which there is no control. Mr. Pfeffer would have us continue the "Hands-Off" policy that was so vociferously advocated a few years ago, and let China sink and in sinking, drag others down with her. In the face of the facts, it sounds too much like a doctrine inspired from Moscow, for then the ultimate triumph of Communism is certain. We agree in that there has been too much intervention in the past, but as we have tried to make clear, it was based on a false conception of what was best for China and for ourselves. At any given crisis during the past twenty years the course of events could have been given a different turning by wise statesmanship on the part of the Powers and we believe even at this moment that the mistakes of the past can be retrieved and events shaped along lines that will assure to China a more brilliant future than that conjectured by Mr. Pfeffer.

Between Mr. Pfeffer's philosophical explanation of cause and effect and Mr. Abend's clean cut, fearless and sensational exposition of facts and conditions there is little difference except in the conclusions as to how the future stability of the country can be assured. If there was no Red Menace lurking in the background and Nanking could have time to work out its problems in its own way, it could be trusted to find some solution in harmony with the traditions of the people and contribute much for the advancement of human progress, but with the Five Year Plan of Moscow now in its third year period and a determination to dominate Asia and regain its lost supremacy in this country, the time is far too short for Nanking to solidify its authority and place itself in a position to withstand the Soviet pressure.

It comes down, as Mr. Abend points out, to the choice of two programs represented by two schools of thought in violent opposition.

> "One has adopted such slogans as "Hands Off China;" and, "Let the Chinese settle their problems in their own way." This school is to a large extent made up of optimists who see in every new turn of events and in the rise of nearly every new leader the quick deliverance of the country from wars, lawlessness and misery. The other school declares that the Chinese are racially incapable of ever evolving a modern government, insist that the Chinese as a people offer a mass case of arrested mental development, and that this "child-mindedness" makes it necessary for the white races to take over the administration of China."

Mr. Abend rightly rejects the last idea and says that the race that which can produce some of the great and able Chinese living in China to-day is not a "child-minded" race. The common people may be backward and alien-minded" but inferior, emphatically no!

> "Because so many tens of millions of Chinese are backward, because events have conspired to nearly bankrupt the country at the same time that it has become dominated by hordes of hungry armies, China has become unable to manage her own affairs. If a selected group of Chinese patriots and administrators were to be supplied with adequate funds, they could no doubt bring order out of chaos. Money could purchase quietude on the part of restless generals, could disband the armies, and could launch great and needed public works which would give employment to the discharged soldiers. Prosperity would return to the land."
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> "But money to the extent of the hundreds of millions necessary for these enterprises will not be forthcoming under present conditions. If, by a miracle, the disbandment could be effected and the public enterprises be begun, then money would flow to China seeking profitable investment—always supposing that absurd anti-foreignism did not keep it out."
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> "Lacking such a miracle, the only alternative seems to be an international intervention—a benevolent intervention undertaken solely to end China's misfortunes both for the sake of the Chinese people and because of the prosperity which a proper settlement of China's problems would help to bring to the rest of the world."
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> "Compulsion exercised upon a nation from outside usually follows the failure of the nation in question properly to administer its own affairs. The fact that the population of a given portion of the globe is indigenous to the area it holds, gives no perpetual title to that area unless that population can prove its fitness to administer and develop the land it occupies."

Mr. Abend points out that the League of Nations is obviously not the organization to take up consideration of the problem of helping China, as the United States is not a member of the League and the United States has always been China's friend and protector. He suggests, however, that the Powers which signed the Washington Conference agreements might consider acting, or the signatories to the Kellogg-Briand treaties might be called into conference. In his opinion, the mere calling of such a conference would so shock and alarm the Chinese leaders that they might of their own accord reach some agreement which will give the people of China at least a breathing spell. Failing such a happy and alas! not altogether probable effect, the Powers would then be justified in warning China that if peace were not arranged within a given time and some beginnings made for the rehabilitation of the country, a benevolent intervention would be begun.

> "As to Chinese resistance, the intervention could be so clearly grounded as to purposes and aims, that it need not be humiliating to Chinese patriotism, and if it were properly conceived and carried out it would probably win a surprisingly large measure of Chinese support—for the Chinese people are war-weary to a profound degree and many of the educated classes would probably rather accept a benevolent international intervention than run further risk of the Communistic dictatorship of illiterate peasants and coolies.
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> "The Chinese people to-day are powerless to check the destructive process which are bringing about the ruin of their country and coincidentally are creating a serious menace to the peace and well-being of the whole of mankind. Humanitarianism alone should prompt the rest of the world to devise some means of giving immediate help to these people who cannot help themselves, and self interest and the instinct of self-protection also counsel against delay."

However much the school of "Hands off China" may disagree with Mr. Abend's conclusions, he at least points a possible remedy, a way out of the morass Mr. Pfeffer leaves us floundering in. If China is to be assisted to get on her feet and present a determined front against Communism, Mr. Abend is right in that some form of benevolent intervention must be applied to strengthen the present régime. The difficulty is the reluctance of Nanking to admit its failure and accept any plan originating from without. The time was when these same Kuomintang leaders appealed for this help and would have accepted any overtures that would have strengthened there cause. Twenty years have been wasted and the nation ruined by an intervention that supported morally and materially the Peiyang group of militarists and it is hardly to be expected that the followers of Dr. Sun Yat-sen will acclaim any program emanating from the Powers whose blind support of Peking made their task more difficult.

(Continued on page 673).

A Record of Progress

Two Years of Nationalist China

THE history of China in the last two decades is the history of the Kuomintang and this is particularly true of the period since October 4, 1928, when after unifying the country, the Party delegated its power to the National Government to lead the country through its period of tutelage and prepare it for constitutionalism. Real unity, however, has never existed except on paper and for outside political effect and the history of the past two years has not varied in any essential from that of the past two decades, a long, tedious and sickening succession of treachery, double-crossing and opportunism, true to the political traditions of the country. The Nationalist Government has been compelled to fight a continuous war to preserve the fiction of its authority and in so doing has exhausted the finances and credit of the nation and made difficult the carrying out of any real constructive legislation. That a government so beset with opposition could find time to execute any of its development plans is a sufficient testimonial to its character and efficiency. The constant wars, sieges, military movements and political intrigues have so overshadowed all other events in China that it has been impossible to focus attention on the other activities and accomplishments of the Government. In "*Two Years of Nationalist China*," Mr. M. T. Z. Tyau, Director of the Intelligence and Publicity Department of the Ministry of Foreign Affairs, has gathered together in one volume an accurate and official résumé of what the National régime has accomplished to date.

Mr. Tyau gives us some idea of the herculean task of the government to consolidate its position in a detailed description of its endeavors and achievements, it's hopes and disappointments, well meaning intentions and discouraging realizations. Instead of being vouchsafed even a few years of peace and order "the Gods of Olympus" have willed uninterrupted insubordination and defiance of the Central Government, and to-day notwithstanding the recent victory over the Feng-Yen armies, the National forces are still grappling with the problem of establishing its authority and cleaning up the regions overrun by bandit and communist armies. The task of pacification is as great as that of unification.

Mr. Tyau is an optimist. He has to be. If China is to survive as a political entity, the Kuomintang must consolidate its rule or give place to another military despotism. It is all a question of time and Mr. Tyau pleads for a full measure of kindly sympathy and good-will, for friendly counsel, constructive criticism and discerning patience on the part of foreigners in order to assist the Chinese in their task of national reconstruction.

The Powers may have made mistakes in the past and contributed to making the Kuomintang program more difficult of success, but there can be no criticism of their attitude since the Nationalist Government began to function at Nanking. Nanking has received more proofs of this sympathy than any other previous government in China. If there is any reluctance on the part of the Powers to accede to all the demands of Nanking, it is not due to any lack of sympathy with its program but to the stern realities of a situation that even Mr. Tyau is forced to recognize in describing the difficulties confronting his government. It is to be hoped not only for the future of China but the well-being of all who reside within her borders or who have relations with her, that Nanking will succeed in its program and that the day will arrive when extraterritoriality can be safely abolished and the last vestiges of foreign intervention removed by the surrender of the concessions.

Something of the enormity of the task that confronts Nanking, may be gathered from the fact disclosed by Mr. Tyau that the enrolled membership of the Kuomintang Party is only 266,338 and of this number only 12.79 per cent have received a collegiate education, classified as follows: Technical colleges, 5.57; Universities 6.40; Returned Students from Europe, .12; from America .14; from Japan and Russia. 56. It seems obvious from these figures that the Party has not the educated personnel to fill the important government posts during the period of tutelage. The Kuomintang of to-day, is not the Kuomintang of 1913, nor even of 1924. To quote another Chinese authority; "When the Kuomintang grew to be a powerful organization and its membership meant a meal ticket, all the sycophants and ne'er-do-wells, pledged their allegiance out of sheer necessity. It was there and then that all the high political ideals which Dr. Sun and his immediate supporters has cherished, encountered failure....."

Mr. Tyau's compilation on the organization, functions and programs of all the administrative departments of the Nationalist Government and what they have accomplished to date, is a great help in formulating a proper estimate of its aims and aspirations. His book of over 500 pages is in reality an Official Hand Book of the Nationalist Government and is so replete with authoritative information on every activity of the various administrative organs that it becomes invaluable as a book of reference. With certain additions as to personnel, expenditures and other data, the book should be expanded into a yearly official document, that would stand as the authority on the government's activities and progress.

The sections of the book devoted to Home Affairs; Foreign Relations; Military Administration; Education; Public Health; Mongolian and Tibetan Affairs; Opium Suppression; Famine Relief; Legislation; Justice; Civil Service; Supervisory Control and Local Governments, is the first really intelligent information disseminated in English on the functioning of these departments. To those concerned with the material achievements of the Government and its future constructive program, the sections on Finance; Agriculture and Mining; Communications; Railways and National Reconstruction are of such value that the book should be in the hands of every engineer, financier and commercial firm interested in any or all of these activities. All the information necessary for an intelligent understanding of what the Government hopes and plans to do is here under one cover.

In the matter of these various technical programs, the Nationalist Government has evidenced a sincere desire to be guided by the highest foreign expert advice obtainable, and can point to the work of the Kemmerer Commission in evolving a plan of financial reorganization and recommendations concerning monetary reform, revenue policy, budget, accounting control and restoration of the national credit, as a sign of the soundness of its policy and to the fact that several experts of the Commission have been retained for service in the Ministry of Finance.

The entire construction program of the other ministries must of a necessity be made to conform to that of Finance and it is not too much to say that the Government will stand or fall on whether or not Minister T. V. Soong is permitted to carry through his ideas as to the budget and curtailment of military expenditures. In fact, the future of China under any government will hinge upon the ability of that government to collect, control and disburse its revenues, free from military or provincial interference. The problem is one which no single ministry can solve alone. The future of democratic government, economic reconstruction, foreign relations and financial progress is a challenge to the patriotism and statesmanship of the Government and members of the Party, calling for the loyal and patriotic co-operation of the entire nation. It is a tremendous task to shoulder on to one official. It is for this reason that where foreigners are concerned, the outstanding personage of the Nationalist Government is its American-educated Minister of Finance, Mr. T. V. Soong, upon whose program rests the success or failure of the Kuomintang dictatorship. Generalissimo Chiang Kia-shek and other members of the Executive Council may have to carry the burden of internal affairs, but these are of only superficial interest to the outside world, concerned solely with trade and industrial development arising from peace, prosperity, and restoration of the nation's credit. There may be others as highly placed and perhaps better qualified to direct the finances of China, but the world as yet knows them not. No official of the old school could now inspire confidence abroad in China's credit and the appointment of any of the old gang or untried Kuomintang enthusiasts to succeed T. V. Soong, would destroy whatever hope or confidence that still remains in

China's good-faith in financial matters. So, for better or worse, the future of the Nationalist Government hinges largely upon how its finances are collected and administered. Mr. Tyau's section on Finance closing with Mr. Soong's report dated March 1, 1930, must be revised to include the enormous expenses incurred by the Government in the recent civil war, which although officially terminated, still drags along.

The section on Industry, Commerce and Labor, is interesting as outlining the future program for the creation of Basic Industries such as iron and steel, electric and hydraulic plants, machinery factories, salt and chemical works, cotton and paper mills, gasoline works and an International Exchange Bank, all of which will require a total outlay of $200,000,000.

The section on Communications is concerned with Telegraphs, Telephones, Wireless, Postal Administration, Air Mail, and Navigation. Here the National Government can show real progress and proof of its good intentions. There are now 1,105 Telegraph offices under control of the Ministry, with a total of 181,261 miles of lines. High-speed automatic telegraph instruments are to replace the older equipment now in use. The country is divided into nine radio districts with a total of 52 short-wave and seven long-wave stations belonging to the Ministry. Altogether, there are 167 wireless stations in China, a remarkable showing, considering the unsettled state of the country during the past ten years.

A contract for the purchase of a 15 kw. short wave radio set was made with the Societe Francais des Telephones Interurbaines, agent of the Societe Francaise Radio Electrique of Paris. Another 20 kw. set has been bought from the Radio Corporation of America and both transmitting stations are being erected at Chenju, and the receiving stations at Liu Hong, near Shanghai. Branch stations will be erected at Shanghai, Tientsin, Hankow and Canton. Arrangements have been made with the Telefunken Company to put up four substations for transmitting messages from the above named cities. The R.C.A. station at Chenju has just been completed and opened for service.

Great strides are being made in the development and improvement of the telephone services throughout the country. Automatic equipment is replacing the old magneto and common-battery systems in the larger cities. Tientsin, Nanking, Tsingtau, Shanghai (Chinese City), Wuhan (Hankow, Hanyang and Wuchang) and Canton, under control of the Ministry, are all being modernized with automatic equipment.

Air mail services have been established and new routes are being opened as conditions permit. The Nationalist Government can point with pride to the achievements of its Communications Ministry during the past two years.

The Railway Ministry has not been so fortunate. Dr. Tyau gives a very complete outline of the program of this Ministry which, alas, has never been permitted to exercise its authority over the operation of all the lines that come within its scope. As with the general finances of the country, there is no complex problem surrounding the profitable operation of China's state railways. If there was no military interference and the rolling stock could be released for commercial traffic and the revenues of all the lines paid into the ministry, the earnings would suffice to pay all outstanding indebtedness, maintenance, rehabilitation and other charges, and still leave a comfortable surplus of twenty to thirty million dollars as security for further construction loans. China's railways, despite military interference with their operation, are still the most economically operated lines in the world.

Minister Sun Fo has also sought the advice of experts in devising plans for rehabilitation and construction of new lines. Mr. W. B. Poland, one of America's foremost railway engineers, made a most thorough report for the Kemmerer Commission and Mr. R. B. Mantell covered every need of the lines for rehabilitation. Dr. Waddell, the bridge expert, designed plans for all new major bridges, including those projected over the Yangtze at Hankow and Hanyang. But all these plans have to await peace and restoration of the lines to the control of the Ministry.

Mr. Sun Fo has been unable to carry out any part of his program as the militarists absolutely refuse to surrender their main source of income and facilities for quick troop transportation. A large percentage of the rolling stock of the lines belonging to the government, is now in Manchuria, being used for equipping the new lines of the Mukden government. They are simply spoils of war. Mukden has the material and Nanking can purchase new cars and locos. Until all the railways in the country, including those in Manchuria, are brought under the direction of the Ministry of Railways, the plans for rehabilitation and financing new construction can proceed only as funds are released from within or from other sources (such as remitted Boxer Indemnities) which do not involve the flotation of a foreign loan. The real test of national unification lies in the management of the state railways. Until Mukden hands over all the rolling stock that belongs to the railways south of the Wall and recognizes the right of the Railway Ministry to direct the government lines in Manchuria, unification is a farce.

In spite of a recent order of the National Government Council requiring that all rolling stock be returned to the Ministry of Railways, up to December 10, a total of only 10 locomotives and 133 passenger coaches and freight cars have been released by the military, one-fourth of the number of locos and one-twentieth of the cars retained by the militarists within the Wall. The Minister has been compelled to request the despatch of six of the Commander-in-chief's staff to accompany his deputies along the various lines to supervise and accelerate the release of detained rolling stock. And even this does not include the Peiping-Liaoning (Mukden) and the Manchurian lines.

As in Finance, the Railways are directed by a Minister and group of foreign trained engineers and experts, who typify all that is best, not only in the Kuomintang, but in the whole of modern China. It would be difficult even in some of the more advanced states of Europe to find a technical personnel with greater ability, energy and determination to make good. One of the saddest phases of the whole revolutionary period is the picture of a generation of foreign-educated engineers and specialists of exceptional qualifications and high ambition being condemned to a life-time of inactivity, uselessness and stagnation, their legitimate hopes of being able to contribute to their country's greatness and advance thwarted by a group of ignorant bandits, horse-thieves, coolies and other scum who have risen to the command of armies and enforced their will upon the nation. Young men who left our colleges twenty years ago with diplomas as engineers, taken post-graduate courses in other branches of technical activities, even serving their time in industrial plants to obtain a practical basis for their future life-work, are to-day ekeing out a mechanics existence on a paltry salary, with all hope of advance dependent upon the whim of some ignoramus dressed up in uniform, whose only use for their services is to keep the revenues rolling into his pockets as long as the rails last, the bridges stand and the wheels can be made to revolve.

Mr. Tyau asks for sympathy and tolerance during China's present upheaval, but more than anything, he is asking consideration for his own department. He and his foreign-educated colleagues don't need any sympathy. They are highly articulate, able to hold their own in any argument or discussion. Foreigners at times may disagree with, ridicule or criticise them, but it is no one-sided war of words. This group is quite able to champion China's cause in any forum or newspaper controversy and command the respect of their opponents. These men stand in a class by themselves, on a plane of full equality with their friends and critics and in the present inevitable conflict of policies and interests must expect their propaganda to be answered in kind. When they attempt to carry their case by concealing facts, muzzling the press and stifling free expression of thought, they cannot always expect to receive friendly consideration and whole-hearted sympathy from the other side.

If there is any sympathy to be extended to the Nanking régime, a large share of it should go out to the group of inarticulate officials upon whose shoulders the practical task of reconstruction will devolve. The foreign-educated politicians of the new régime have won their spurs and can take care of themselves. None of their technical colleagues had an opportunity to make good until the National Government came into existence. They are in Nanking now, working on plans and estimates for all manner of large scale public improvements, railways, bridges, harbor and river conservancy, sanitation, highways, power plants and other developments that will do more to elevate China to her proper place amongst the nations, that all the propaganda bunk of the professional political groups.

Something of the tremendous task of reconstruction confronting the technical group, can be gleaned from Mr. Tyau's chapter on this subject. The Government is adhering faithfully to the outline of development laid down by Dr. Sun Yat-sen and,

in addition, is undertaking harbor and river improvements, electric power development, mining and forestry, and other huge industrial projects. The technical work of the National Reconstruction Commission is distributed between the Electricity and Convervancy Departments, having the following institutions under their control.

1. Nanking Electricity Works.
2. Tsishuyem (Wusih) Electricity Works.
3. Electrical Manufacturing Works.
4. North China River Commission.
5. Taihu Basin Waterways Commission,
6. Great Eastern Port Development Board.
7. Great Northern Port Development Board,
8. The First Irrigation District Commission.
9. Chang Hsin Coal Mining Administration.
10. Hwai Nan Coal Mining Administration.
11. Central Forest District Commission.

The program of the Electricity Department is to build up power systems all over the country which will be divided into districts controlled and supplied by a number of efficient central stations, hooked-up by high tension transmitting lines. All small, uneconomical plants are to be eliminated and replaced with substations fed by the proposed net work. A start is being made in Kiangsu and Chekiang where the Nanking and Wusih plants will be utilized as the first units of the Kiangsu Power System while the plant at Hangchow will serve as the central unit for the province of Chekiang.

The plans for Nanking call for a new plant of 15,000 kw. with an ultimate capacity of 60,000 kw. to be completed in two years. For the Wusih plant, an extension of 3,200 kw. has been ordered while for Hangchow the first 15,000 kw. unit has been ordered for a plant designed for 60,000 kw. capacity. China has now 575 electric light and power companies, aggregating 527,240 kw. of which, 17 plants are owned by the Government. Most of these enterprises being private and inefficiently managed, the Reconstruction Commission is authorized to regulate and supervise them. The plants already brought under the direction of the Commission have shown surprising results in reduction of expenses and increased efficiency ; a good argument for a further extension of governmental control.

The Commission has also taken over two coal mining properties, the Chang Hsing and the Hwai Nan Coal mines and is now engaged in improving the plant and workings and increasing output. The Government Radio and Electric Works in Shanghai has also been taken over by the Commission and reorganized into the Electrical Manufacturing Works. Besides producing radio transmitters and receiving sets, the plant is preparing to manufacture standard electrical supplies for the power industry. A new plant has been built on the south bund of the Whangpoo River near Shanghai and large scale production will be started early next year.

Irrigation forms a prominent feature of Reconstruction in connection with the development of power plants. Electrically driven irrigation pumping stations are to form part of the three initial power stations at Nanking, Wusih and Hangchow. The First Irrigation District is to be established in Wusih and Changchow and plans are being drawn to establish at least one model irrigation district in each province, beginning with those in the vicinity of Nanking and in the provinces of Hopei, Anhwei and Chekiang.

In river conservancy and port development the commission is also facing a tremendous task, the carrying out of which depending upon the release of revenues now diverted almost entirely for the maintenance of the armies. Since the reorganization of the commission, the following river improvement schemes have been drawn up ;

(*a*) Plans and estimates for the improvement of the Haiho.
(*b*) Plans and estimates for the improvement of the Yung Ting Ho.
(*c*) Plans and estimates for the closing of the dyke breaches of the Yung Ting Ho, 1929.
(*d*) Plans and estimates for the proposed escape channel from Tu Liu to the sea for the relief of the flood waters of the Yung Ting Ho, Ta Ching Ho and Tse Ya Ho.
(*e*) Plans and estimates for the improvement of the Grand Canal between Peiping and Tientsin.
(*f*) Plans and estimates for the improvement of the Chien Kan Ho and Chi Yun Ho.

In June 1929, the former Taihu Basin Conservancy Board was reorganized as the Taiho Basin Waterways Commission, with head office at Soochow, to take charge of the river system in the Taihu Lake Basin. Since it's reorganization, the following river improvement schemes have been prepared ; Plans for the improvement of the Woosung Kiang, the Hsu Kiang and the Grand Canal between Chinkiang and Changchow. In January and July 1929, two boards were organized for the development of two big ports, one on the east coast between Chapu and Kanpu, (Chekiang) known as the Great Eastern Port of Dr. Sun's scheme and the other on the north coast between Taku and Chingwangtao, known as the Great Northern Port.

In his section on Opium suppression, Mr. Tyau is honest enough to admit that in the task before the Commission in charge of this work, the main difficulty arises from within. He says :—

"In the face of tremendous handicaps—particularly civil war, where selfish militarists countenance, if they do not actually instigate, the growth of poppy as well as sale of opium in order to recoup their treasury, and insurbordination on the part of military commanders as well as provincial authorities who concert together to defy the Central Government—the task of opium suppression has been an up-hill one. The public conscience, has, however, been awakened and the resolution of the National Government is unenviable. What is needed to crown the nation's efforts in this direction is an opportunity vouchsafed by the cessation of civil strife and achievement of real unity."

Just so ; short, sharp and to the point. If China's delegates at Geneva will admit the same truths, much acrimonious debate would be avoided. However, now that the official spokesman for the Ministry of Foreign Affairs puts this admission in black and white, there is nothing more to be said. With the equally important testimony of Mr. Jermyn Chi-Hung Lynn in his recent book "*Political Parties in China,*" concerning the position of opium in these various civil wars and taxation schemes, even in Canton under Kuomintang dictatorship, we will probably hear less about the culpability of the foreigner for the present widespread use of the drug.

Mr. Tyau's chapter on Planning the New National Capital, goes into many interesting details that deserve special reproduction. The Nanking City Planning Bureau was organized pursuant to a government order on November 1, 1928. Mr. Lin Yi-min (Y. M. Lin) an American trained engineer, was chosen as director to take charge of the administrative duties ; while most of the planning work was performed under the guidance of two American advisers, Messrs. Ernest P. Goodrich and H. K. Murphy, respectively, consulting engineer and architect of prominent standing in New York City. The latter were assisted by two other Americans, Col. I. C. Moller and Mr. T. T. McCrosky and by a group of Chinese engineers. Mr. Cho Yueh (W. Y. Cho) was chief of the engineering staff and Mr. Huang Yu-yu (Y. Y. Wang) principal architect assistant.

The plan was completed on December 31 last, and the detailed recommendations were included in a comprehensive report in English prepared by the advisers. The report covered : (1) the background and scope of the city plan (geography and climate, history of Nanking boundaries of metropolitan Nanking, population etc.) ; (2) Government building groups (National Government Center, Municipal Government Center, and architecture) (3) Transportation and transit (railway tracks and terminals, port development, aviation and airports, transit and bus transportation) ; (4) Laws for the control of land development, including the National Government Enabling Act for Municipal Planning and Zoning, Nanking planning and zoning legislation ; (5) Streets, canal and parks (street system, highway system for Nanking region, paving, traffic control, canals, parks, parkways and recreation) ; (6) Special problems such as street utilities, location of electric light and power station, water supply, drainage and sewerage, industrial survey, housing, schools, development of Pukow etc. ; (7) Carrying out the plan (order of urgency of projects, finances etc.)

This work is being pushed forward continuoulsy in an orderly manner, as finances will permit. With the exception of Canton, no city in China had previously attempted scientific city planning. At Nanking, the work was done on a much more comprehensive scale, and will therefore exert more influence on the country. Shortly after Nanking initiated her city planning work, the Municipality of Greater Shanghai engaged a staff of experts to continue the work of an American City planning commission. Nanking's example was

also shortly followed by Tientsin. It is reasonable to believe that in future all large cities will awake to the need of sound city planning. Mr. Tyau is correct in stating that the work done at Nanking will serve as a model and an inspiration to the rest of the country, ushering in a new era of city development and administration in China.

On the whole, Mr. Tyau is to be congratulated in presenting the public with such an admirable résumé of what has been accomplished to date in all departments of his government. Much preliminary ground work has been covered and to the criticism that Nanking has wasted a lot of time and money in planning huge development works, the answer is that these various propositions which before were largely in the air have been thoroughly investigated and whipped into practical shape, with plans, specifications and estimates drawn up ready at any time to proceed with the work as finances permit.

It is a long story, a record of solid achievement in things which do not appear on the surface. They constitute Progress and hold out great hopes for the future. As Mr. Tyau says: "Today, the armed forces of the National Government are still grappling with those of the secessionists in a life and death encounter." They are still in the field engaged in the more difficult task of pacification, rounding up the lawless elements and suppressing communists. But, he says, "there is no question but what the morrow will bring. Factors, that make for unity and solidarity, for progress and reconstruction, for enlightenment and prosperity, as well as the greatest good of the greatest number, must triumph eventually. Nothing can stay the operation of this inexerable law. In the confidence in the ultimate outcome that has inspired the National Government to set their faces forward and plan for the future—plans which will continue and consummate the work already begun and which will rebuild a Republic worthy of its great heritage; may we hope that some measure of this self-same confidence will be shared by the well-wishers of the Chinese people?"

G. B. R.

At Last; The Truth About China

"Political Parties in China," by Jermyn Chi-Hung Lynn, LLD.! Published by the French Book Store, Peking.
"The Inner History of the Chinese Revolution" by Tang Liang-Li; Published by George Routledge & Sons, Ltd., London

At last the outside world is permitted to glimpse what has actually taken place behind the screen in China. For years, all the worth while books on the country have been written by so-called foreign experts and authorities, but in the last two decades a group of young Chinese graduates of European and American colleges have entered the field as exponents of their own problems. Up to last year, the majority of these books and studies have been concerned almost exclusively with international politics defending China's case against the unequal treaties and so-called outside aggression. When the Kuomintang united the nation and arrogated to itself the exclusive right to dictate its affairs, it excluded from membership and participation in government many of the most brilliant minds in this new group. These men, frozen out of public life, are now revealing the inside working of what passes for politics in their country.

For a perfect understanding of what it has all been about, read "Political Parties in China" by Jermyn Chi-hung Lynn, an answer to the propaganda of the Kuomintang and writings of sentimental idealists who see behind the present movement a real urge on the part of a people towards Democracy. The author is an authority on his subject. For fifteen years he was a secretary in the Ministry of the Interior in Peking and at different times served as adviser to Wu Pei-fu, Chang Tso-lin, Tuan Chi-jui and other leaders, with unusual opportunities of following the inner workings of events in the recent political life of the country.

Even to those of us who have labored under the delusion that we knew something of what was transpiring, this book comes as a revelation, an astounding exposé of what has been going on behind the scenes. How often have we been puzzled to account for currents and cross currents, the permutations and combinations, the transformations and re-alignments, the sudden conversions and almost imperceptible evolutions and involutions of Chinese political parties and personalities of the past few years? How often have we been misled by the political clap-trap of skilled propagandists or glib spokesmen of the war-lords into accepting their highly colored explanations of political happenings in China, yet all the time feeling that the truth was being concealed?

Well, at last we have what purports to be the truth from a Chinese source, and we find that the science of warfare and politics as practiced in China has undergone no change in four thousand years. The picture so graphically painted by Mr. Lynn is the most nauseating recital of betrayals, double-crossings, perfidies, bribery, cowardice, assassinations, corruption and vice that has ever been presented as political history. There are only two personalities in the book to relieve the sordid monotony of political debauchery; (Dr. Sun Yat-sen and Wu Pei-fu) two honest men and patriots in a fantasmagoria of grafters, crooks, assassins, opium fiends, gamblers, Judas Iscariots and worse, who at some time or other have come to the top and directed the affairs of China through leadership or membership in some political party or clique.

Dr. J. C. Ferguson, unquestionably an expert and one of our best Chinese scholars, writing a foreword to the book, reminds us that:—

> "Political parties like individuals have race characteristics. In China there is a tradition that it is the duty of those in power to set an example which the people may follow and with this as a basis it can be said that the primary object of all political parties has been to seize power so as to be able to bring their ideas to the attention of the masses. Kang Yu-wei and Liang Chi-chao had been distinguished writers on political topics for several years before they attempted to gain the controlling power of the State through their influence over the Emperor Kuang Hsu. They believed that this power was necessary in order to make possible the carrying out of the reforms which they advocated. Their example has been followed by all subsequent party organizations which have one by one seized the reins of government. The only party which has succeeded in gaining an approximate control of the whole country is the Kuomintang, usually called the National Party. Since it seized the government by its successful military campaign, it has had as its aim the forcing of its political theories, as embodied in the San Min Chi I of Dr. Sun Yat-sen upon the people. In pursuing this course, it has followed the traditional methods of all previous political parties in China."

Dr. Ferguson has lived and moved in the midst of these changes and is perhaps the most competent foreign authority on the policies and politics of the various régimes which have ruled the Chinese nation from Peking for the last two decades. When this expert vouches for the historical accuracy of the book and its absence of political bias, it cannot be lightly set aside and ignored. "More of this type of writing" says Dr. Ferguson, "is desirable and necessary in order that intelligent persons may understand the trend of current events and their inevitable implications."

Another book on the same general subject is entitled "The Inner History of the Chinese Revolution" By Mr. T'ang Leang-li, "Representative in Great Britain and Correspondent in Europe of the Central Executive Committee of the Kuomintang. This book shows expert editing and a splendid use of English in which we sense the polishing touch of those masters of publicity directing the socialist movement in England. The book is contemporary history at its best, clear, dramatic and full of detail, another rending of the veil, disclosing to the world the inner workings of politics in China during the revolutionary period and especially during the past three years.

The book is an inside history of the Kuomintang Party leading up to the seizure of power by the group now in Nanking. As in Mr. Lynn's exposé, it relates in detail the spectacular changes of front on the part of the various leaders of the revolutionary movement, giving strength to the belief that peace and stability in China are still a long way off. Mr. Tang leaves us exactly where Mr. Lynn does, who says:—

> "But anyway, it will take a long time before China can witness all her political battles being fought out on the floors of parliaments. At present not the slightest trace of democracy can be found in any part of the country, and the people are divided into tyrants and slaves. Like the other peoples of the world, the Chinese will never be satisfied until they be given a true democratic form of government."

(Continued on page 673).

Trans-Pacific Airship Lines Coming

By FRED M. HARPHAM, Vice-President, Goodyear-Zeppelin Corporation

AIRSHIP travel is the most comfortable mode of transportation yet devised and this fact, coupled with the speed with which great distances are annihilated, is, I believe, destined to make successful the trans-oceanic airship lines of the future.

Long distance travel in a Zeppelin type airship is a delightful experience, and this was proved to a great many persons during the past year by the flights of the *Graf Zeppelin*. The great achievements of the Graf, recorded without furore and in a matter-of-fact manner, went a long way toward pointing out the advantages of this newest mode of crossing oceans and continents, and are indicative of what the public may expect of the air liners of the future.

The statement that airship travel is the most comfortable of all forms of transportation may sound extravagant, but I have tried to compare it with every other mode of travel and that is the conclusion I have reached. The main lounge of the *Graf Zeppelin* is so steady that one dismisses the question of the ship's movement from his mind, there being very little vibration and practically no pitching or rolling such as one sometimes experiences on a liner in a rough sea. The airship goes along for hours and hours on an even keel. Should the ship strike an upgust, or ascending current of air, the nose of the craft may be momentarily thrust upward possibly a few degrees. There is little possibility of any sensation comparable with sea sickness being experienced aboard a rigid airship.

On its last trip from Lakehurst, N.J., the U.S. Naval Air Station and home of the airship *Los Angeles*, the *Graf Zeppelin* crossed the Atlantic to Lisbon, Portugal, *via* the Azores, a distance of 3,410 miles, in 54 hours and 20 minutes. In three days we saw parts of three continents, America, Africa, and Europe, and covered this stretch of water in half the time necessary for the swiftest of surface vessels to travel the same distance.

Flights of the *Graf Zeppelin*, as well as of the *Los Angeles*, and most recently the British ship *R-100*, have demonstrated that rigid airships can weather all sorts of storms and can carry their passengers safely, swiftly and comfortably. The air liners of the future will be even more strongly constructed and better enabled to withstand difficult weather, in addition to being much larger in size and having, therefore, greater passenger-carrying capacity.

The commercial possibilities depend on whether or not the airships can be made to pay. Constructive legislation, such as the McNary-Parker bill, introduced at the last session of Congress, and setting up a merchant marine code of the air, will be of inestimable value in allowing the Government to award mail contracts to airship lines in the same manner as they are now awarded to surface lines. Mail and express contracts will provide a nucleus of steady revenue for the Zeppelin trans-oceanic lines just as they do for steamship and airplane lines.

There have been organized under the laws of Delaware the International Zeppelin Transport Corporation and the Pacific Zeppelin Transport Company, Limited, and both these concerns are at the present securing data on operating costs and schedules for lines from America to Europe and America to the Orient, as well as on locations for airship terminals on both the east and west coasts of the United States.

Not only American lighter-than-air interests, but transportation and banking interests are represented in the two concerns, demonstrating the confidence that business men repose in the infant industry.

It is planned that regular sailings for Europe and the Orient will be made from the American terminals of the two concerns, in much the same manner that surface vessels arrange their schedules.

The ships to be used on the new trans-oceanic lines will probably be larger than anything yet built and will be modeled after the ZRS-4 and ZRS-5, the first of which is now being built in Akron by Goodyear for the United States Navy. This type of ship, containing 6,500,000 cubic feet of helium, when modified for commercial use, can have state-room accommodations for 80 passengers and ample mail, express and baggage space.

The air passenger of the future will go aboard the airship, give his luggage to a steward and locate his stateroom, a comfortable room comparable with staterooms found on the best surface vessels to-day. Spacious promenade decks will be found where the passenger may sit in perfect quiet while gazing at the restless sweep of water beneath. A public lounge, where the voyagers may congregate for reading or bridge, a smoking room, and large dining salons will also be a part of the new ships.

No noise of throbbing motors will bother the airship passenger, whose impression will be that of going swiftly and silently through space. The power plants of the ships are well muffled and located to the rear of the passenger cabins.

Improvements in design made possible by use of the non-inflammable non-explosive helium lifting gas makes possible the location of the eight motors within the hull, instead of in gondolas suspended from the hull, as is the case in all existing airships. This allows better inspection facilities and greatly reduces resistance caused by suspended gondolas. A bevel gear device will transmit power from the motors to the propellers located on outriggers outside the hull, and great improvement in handling the ships on the ground will be made possible by reason of the ability of the propellers to swing into a vertical or horizontal position. Added thrust downward or upwards will materially aid in landings or take-offs.

It will not be many years until the ocean passenger will be able to span the Atlantic in two days, or cross the wide reaches of the Pacific in about twice that time—safely, comfortably and swiftly. He will hardly have had time to thoroughly explore the ship before landing parties at his destination will be docking the air liner.

Airplane connections will be made with incoming Zeppelins so that in a few hours after landing the passenger can be many miles inland if he so desires.

The rigid airship must soon take its place as a definite factor in the economic and transportation scheme of not only America, but other countries as well.

These air transport lines can not be considered as competitive with steamships as they will only serve a small fraction of the public who are willing to pay a premium for speed in transport.

Any additional quick transport of men and mail between nations is always followed by increased commerce, and this commerce means an increase in business for surface ships.

The ZRS-4, first of the two Navy dirigibles, is one-third completed and is scheduled to be ready for service at the end of the present fiscal year. It will be larger than Britain's fallen monarch, having a gas volume of 6,500,000 cubic feet, 1,000,000 more than the *R-101*, and a length of 785 feet as compared to 775 feet of the remodeled British ship. Six times as long as it is thick, it will be slimmer than the ill-fated *R-101*, and eight engines are calculated to drive it at a speed of 83.8 miles an hour while the British ship cruised at 60 miles an hour.

Soviet Shipyards in South and Far East

Upon investigation the Council of Labor and Defense of the U. S. S. R. has found that the shipyards in the South and the Far East are not working satisfactorily. Production costs are considered to be too high and greater efficiency of production is necessary. Of the two sections studied the Far Eastern yards were found to be worse, due to under-capitalization and lack of credits even for urgent work.

The Council urged the Supreme Economic Council to organize the production of the yards in both the South and Far East on a more efficient basis. Those in the South are scheduled to build 545,000 tons by October 1, 1923, of which 80 per cent. will have been launched by that date. The program of the Far Eastern yards calls for 488 steel ships and 400 wooden ships. The number of ships built by these yards which will have been launched by that date is 374 steel and 100 wooden ships.

China's Engineering Progress

Members of the German Industrial Mission Address the Chinese Engineering Association in Berlin

SOME cogent remarks on China's industrial reconstruction and not a few glowing tributes to Chinese engineering genius were heard at the annual meeting in Berlin of the Association of Chinese Electrical and Mechanical Engineers in Germany. This gathering, attended by the Chinese Minister in Berlin, General Chiang Tso-pin, as well as by a notable array of leading German industrialists, financiers and academicians, was made the occasion for a first pronouncement by members of the German Study Commission, recently returned from an extensive tour of China.

It was altogether a very praiseworthy achievement of this little community of Chinese engineering students to arrange an event of such consequence. Although the Association is composed of only fifty members, it is one of the most active student bodies in Germany. It has established excellent relations with the Federation of German Industries, on whose behalf the German Study Commission visited China. Moreover, the Association is now affiliated with the Chinese Engineering Association in China.

After His Excellency, General Chiang Tso-pin, had addressed the assembly, the annual report was read by Mr. Liu, who confined his remarks mainly to an account of lectures and inspection tours that figured prominently in last year's program.

Herr M. T. Strewe on His Tour

Speaking of his own observations and experiences in China, Herr M. T. Strewe, one of the members of the Study Commission, declared that very considerable progress has been made in the last few years and, provided certain preliminary conditions are fulfilled, there is not the slightest doubt that an era of economic prosperity is dawning for China.

There is an endless amount of work to be accomplished in the development of railways, communications, shipping, transportation, and in the general industrialization of the country. Neither does he doubt the possibility of China obtaining the necessary capital for this economic revival.

"I am quite sure," added the speaker, addressing his words to the Chinese students present, "that your country will be able to provide a sufficient number of trained experts for the conduct and management of big concerns. I am likewise convinced that for some time to come a considerable number of foreign engineers will co-operate with success in the reconstruction of China."

Herr Strewe further pointed out that despite the fact of China being the foremost rice-growing country, her imports of rice and foodstuffs represent a yearly total of many million dollars. The same can be said in respect of coal, in which mineral China is the wealthiest country in the world.

Professor Dettmar Speaks

Professor Dettmar, who spoke next, took as his theme "The Electrical Industry in China." By means of a number of charts, he showed how great is the difference between the feed supply of the power stations in Chinese cities during the day and after sunset, thereby revealing that most of the electrical energy generated in China is used for lighting purposes. Only a few big power stations, like the one in Shanghai, can show a consumption that can be termed rational.

Visualizing a time, in the not too distant future, when huge grids carrying overhead transmission lines will convey electrical power to all parts of China, Professor Dettmar contended that such a development of China's electrical industry must necessarily presuppose a much greater use of electricity in the various branches of her industry. Although it is true that, at the present moment, the wages of skilled and unskilled workers in China are relatively low, nevertheless these wages show an upward trend. The outcome of this will be a greater use of electricity in the workshops.

"Nevertheless," declared Professor Dettmar, "some considerable time will elapse before China has her own super-power stations, and it stands to reason that she will have to continue to import the greater part of her requirements of machinery from abroad."

Iron and Steel

Very instructive was the address of Director Dr. Wendt, who dealt with the Iron and Steel Industries of China. Citing the case of the Han-yeh-Ping Concern, which has been doomed to idleness, spite of it being the largest enterprise of its kind in China, Dr. Wendt discussed the reasons for this failure.

"The development of an iron and steel industry," he maintained, "is not only a matter that requires a great deal of expenditure, but it also presupposes a thorough and reliable knowledge of the ore and coal resources, the possibilities of their transportation and an exhaustive investigation of the whole complex problem of location. Adequate capital should be available from the very beginning. If the financial resources are too restricted, difficulties may crop up which will inevitably lead to a closing down of the undertaking. Of the seventeen blast furnaces built in China, there is scarcely a single one in use at the present moment.

"However, the failure of the Chinese Iron and Steel Industry in the past does not at all mean that this industry is incapable of being set on its feet," concluded Dr. Wendt. "Provided one looks squarely at all the manifold problems connected with the setting up of such enterprise in China, and provided one has sufficient capital at one's back before beginning the work, endeavors in this direction will most certainly be crowned with success."

Chinese Students Active in Germany

Mr. Hung-tuchung, who is acting as president of the Association of Chinese Electrical and Mechanical Engineers in Germany, said in an interview he granted me after the meeting that the Association is expecting a great increase in membership during the next year. First of all they are considering the proposition of amalgamating with other Chinese Associations in Germany having the same objects. There is, for instance, a little group of Chinese students who have come here to study city planning, sanitation, modern architecture and allied subjects. This group is rapidly increasing in numbers, and when it joins hands with the "Engineers," there will be talk of having to find more spacious club quarters.

Not all the members of the Association are students. Some are working in the workshops and laboratories of big German engineering firms. Mr. Fatuan Li, a past president of the Association, works at Siemens. He has been there for two years and is returning to China in a month or so. He and Mr. Hung-tuchung have translated the full reports of the German Study Commission into Chinese.—*(Transocean Service).*

Chi Hsin Pottery Works in Manchuria

Pottery making has not been as fully developed in Manchuria as it has in other parts of China, according to Trade Commissioner John H. Ehrhardt, Mukden. Three years ago, however, a modern plant was started in Mukden with a capital investment of $1,200,000 Mexican, employing 400 men, including 150 apprentices. The apprentices have the opportunity to study ordinary school subjects two hours a day, but they work nine hours and receive food, clothing, and lodging for compensation. Practically all the rotating spindles for turning the dishes are power operated, and the plant is managed in an up-to-date manner by a Chinese who received a university training in Japan.

This year the plant is turning out over 600,000 pieces of table crockery per month, valued at $42,000 Mexican, of a quality competitive with the cheaper grades of Japanese pottery. It is estimated that the imports from Japan average 4,000,000 pieces per month. However, the output of this plant is sold profitably at prices considerably below those of the imported Japanese wares.

Hangchow Waterworks

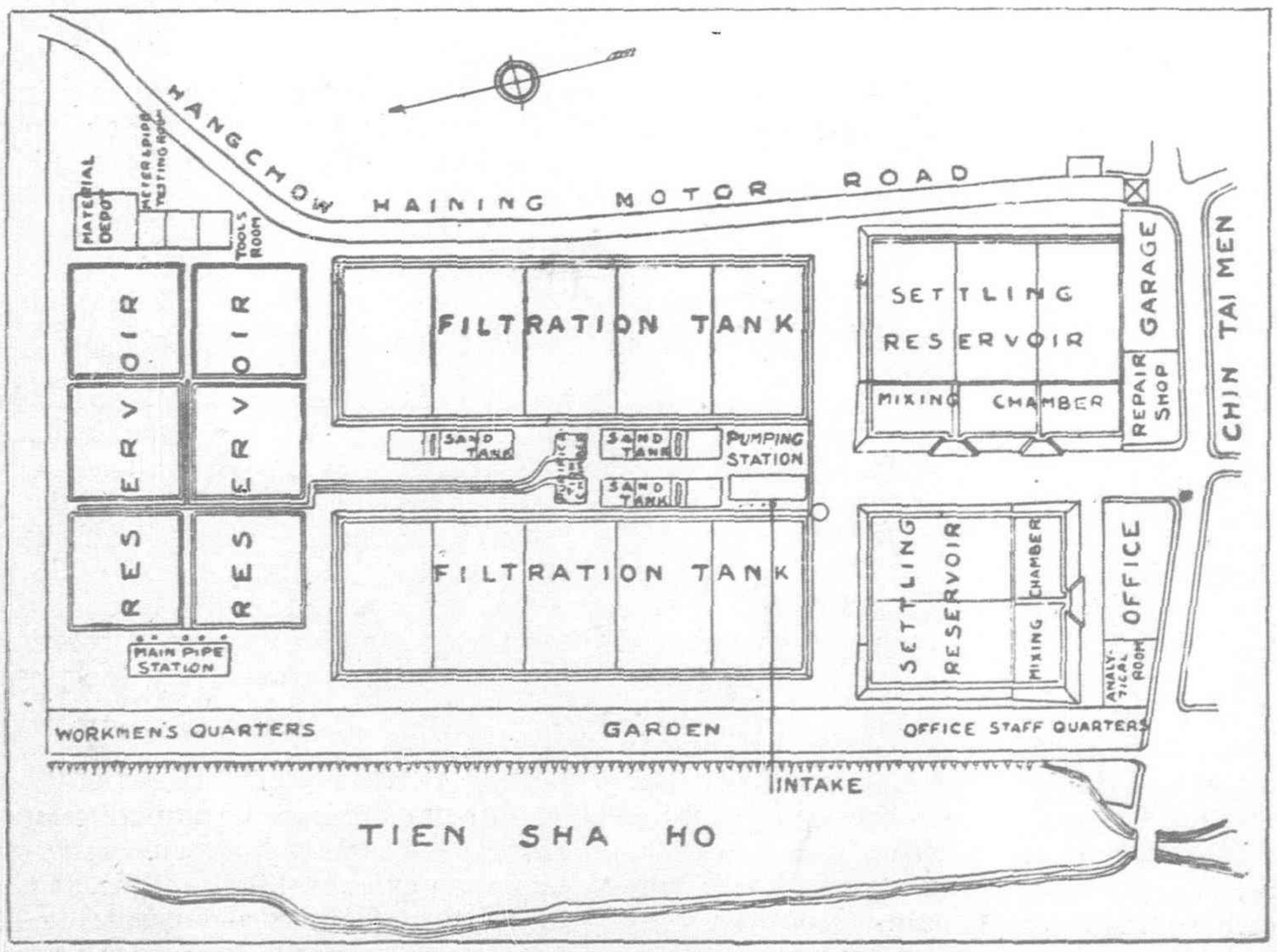
THE city of Hangchow has obtained permission from the Chekiang Provincial Government to issue a ten year $2,500,000 loan for the construction of a municipal waterworks. The loan is secured on the future profits of the waterworks and guaranteed by the Municipal Land Tax. The Land Tax is hypothecated to pay for interest and redemption of the bonds before the waterworks make any profits and thereafter to make up any deficit from this source. The loan, issued at 98, bears interest at eight per cent per annum, payable half yearly. Redemption will begin on December 31, 1933, by semi-annual drawings. The finances are supervised by a committee of six, composed of one representative each from the Provincial Government, City Government, the Chamber of Commerce, the Bankers' Association and the Bondholders. Plans were drawn up last year and a great deal of research work and investigation carried on to determine the most suitable site for a pumping station and intake.

Several proposals were considered, the first being the Chien Tang River, but after careful investigation it was found that at certain seasons of the year the high tides makes it too briny. Artesian wells were next considered, and although the quality of the water was excellent, the supply, it was feared would be inadequate. After prospecting on the different hills, Li-an was chosen. This spring is situated on the hill south of the West Lake and its average flow is estimated at 1,255 gallons per minute which is likely to be sufficient for the city's requirements for some years. The purity of its water also stands the most rigid analysis. But with its distance and the cost of building dams and reservoirs, the capital expenditure entailed would be onerous at present; it was therefore thought best to drill artesian wells as a preliminary measure, and, in case that fails to provide an adequate supply, Li-an would be resorted to. But as the drilling of wells would necessitate a long waiting and in order to get the work started as soon as possible Tien Sha Ho was chosen as a temporary source. This is a river flowing right by the Railway Station and gives a satisfactory supply of water. The main plant will be built there.

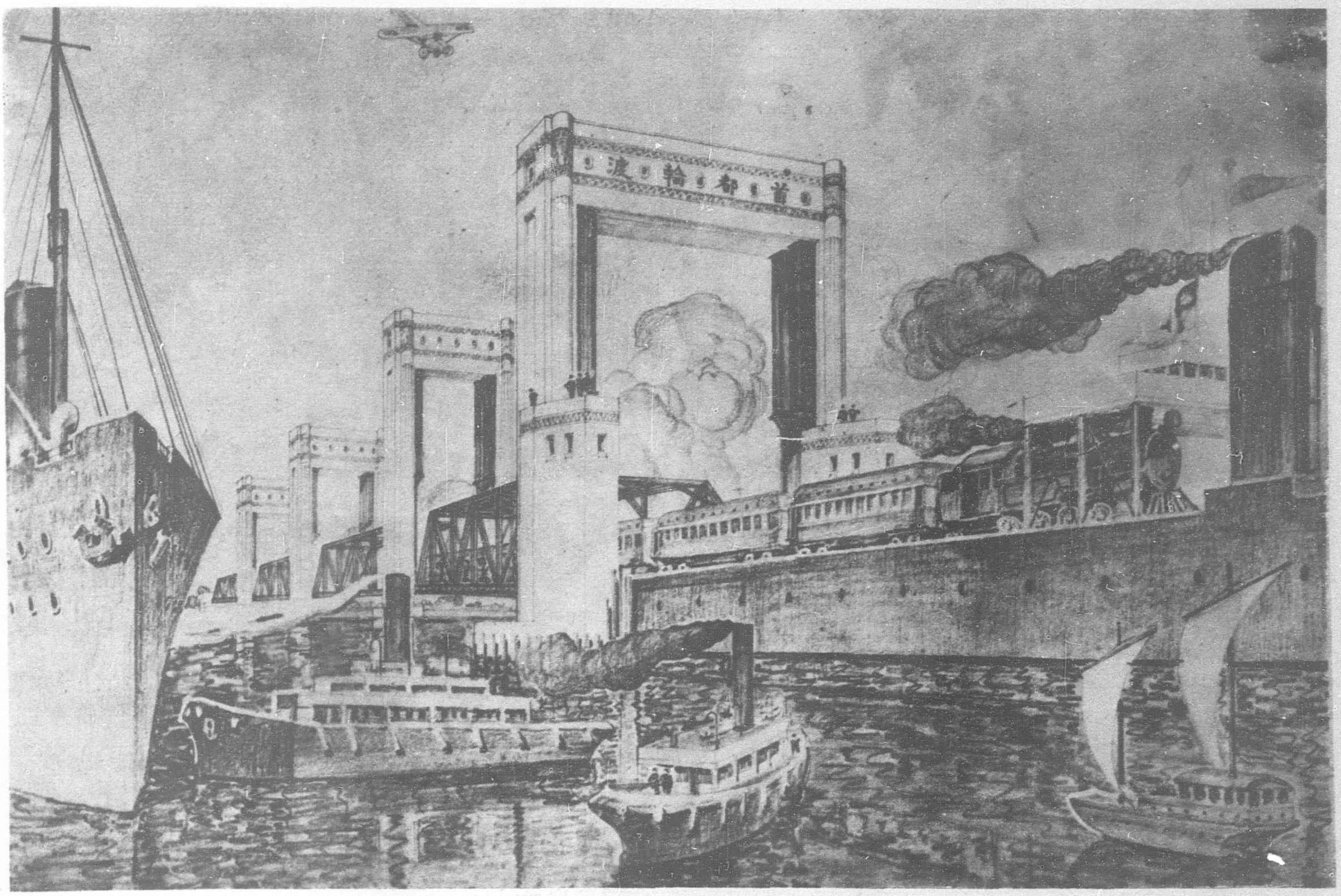
The work on the first stage of the project has therefore been started at the Tien Sha Ho. It is estimated that the supply from this source will amount to 1,000,000 gallons daily. Later on, five wells are to be dug at Li-an to give a supply of 5,000,000 gallons daily for the second stage construction. When the city has developed to where the consumption is expected to reach 50,000,000 gallons daily, the water will be pumped from the Chien Tang River at Chow Chia Pu.

The first pumping and waterworks plant is to be constructed on the banks of the Tien Sha Ho. The order for a low lift pumping plant and its installation has been placed with Jebsen & Company of Shanghai, There will be seven pumps installed with a capacity of 3,800 gallons per minute, or a daily supply of 5,000,000 gallons.

Five settling tanks and two filtration tanks with a holding capacity of 18,000,000 and seven pure water tanks with a continued storage capacity of 10,000,000 gallons are being constructed. The contract for the supply and laying of the 24 steel water mains went to the Siemens-China Company. The length of the mains is 5,740 feet. The contract for the erection of the buildings and tanks was awarded to the Shiu-sing Company. It is expected that water will be supplied to a part of the city by April 1, 1931.



Ground Plan of Pumping Plant and Reservoirs



General View of Proposed Nanking-Pukow Train Ferry

Nanking-Pukow Train Ferry

THE Ministry of Railways of the National Government of the Republic of China has decided to construct a Railway Train Ferry across the Yangtze River connecting Nanking with Pukow thus linking together the Tientsin-Pukow and Shanghai-Nanking lines and affording through passenger and freight service between North and South, doing away with the high expense and delays that has hitherto been a burden to travellers and shippers. The project is estimated to cost about $4,000,000. The Ministry has devised general plans and rough specifications as a guide for tenderers and invites quotations and terms for financing the contract to be submitted at Nanking before noon of February 14, 1931.

This will be the first railway train ferry to be operated in China, and is perhaps applicable only to the lower reaches of the Yangtze, where there is an extreme variation of water level of 24 feet throughout the year and a daily tide variation of one to three feet. In the Mid-reaches of the Yangtze, where the variation is as high as 50 feet, the Ministry of Railways, will as soon as its finances permit, build a railway bridge spanning the river between Woochang and Hankow, to provide through traffic between the Canton-Hankow and Peking-Hankow lines.

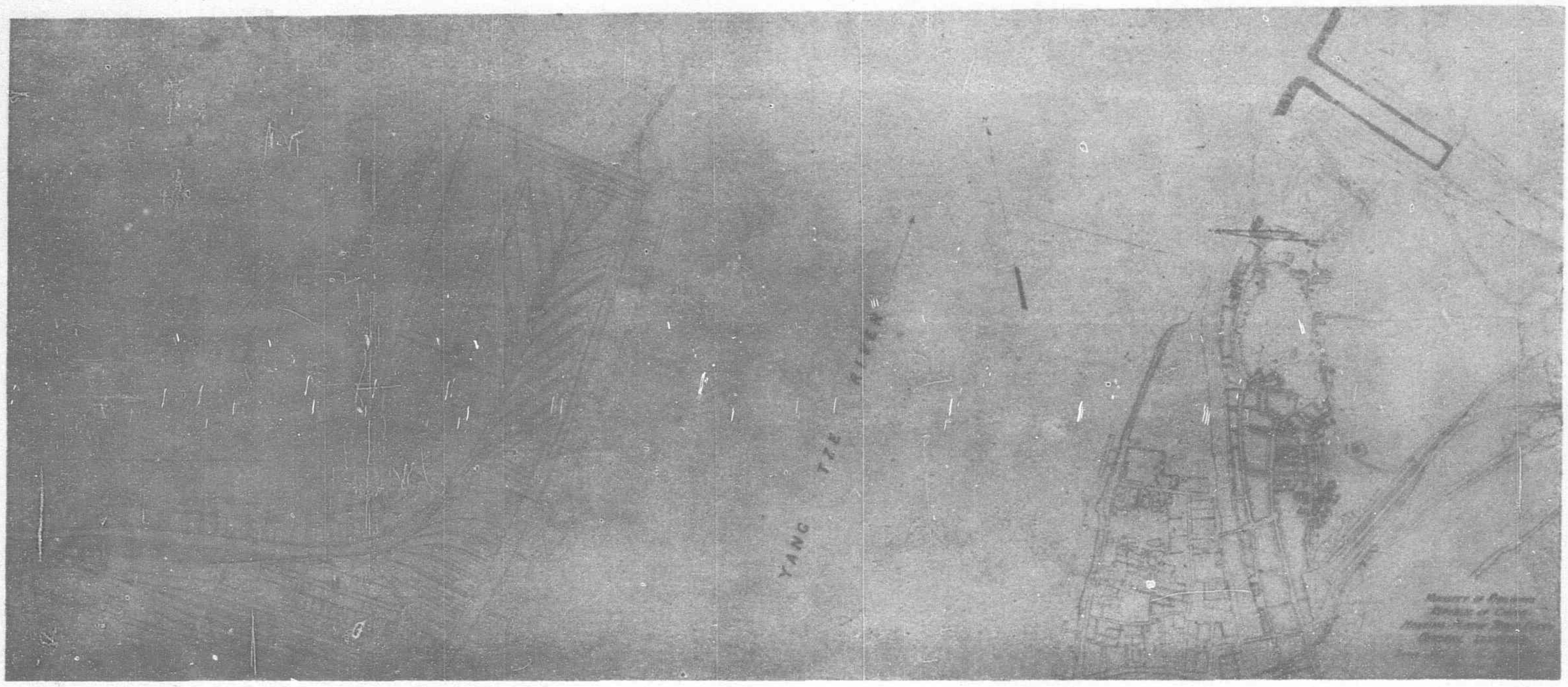
The invitation provides for two distinct types of bids; the first to cover all costs of machinery, equipment and erection and to be paid for by the Ministry. The alternate proposal is for the contractor to undertake the financing and construction under a form of loan agreement to be repaid out of the operating profits of the ferry. The invitations are accompanied by a set of 19 drawings with necessary information or rough specifications. For the benefit of those who might desire to finance the whole contract, there is also a Financial Prospectus showing the volume of traffic over the ferry, with the estimated revenues and operating expenses.

This estimate is an indication of what may be expected in China when internal conditions are stabilized and railway traffic is not hampered by military interference. Over 3,000 tons of freight, will be carried by the ferry daily, and it is noticeable that 1,500 tons represents coal from the Chung Hsing and other Chinese Mines, enabling these enterprises to market their output in Shanghai and compete with other coal landed at the port by steamship. The operating revenues from all sources is estimated as follows :—

Kind of Traffic	*Amount per Day*	*Amount per Year (Counting 300 active days)*
Coal, Chung Hsing Mine ..	1,000 tons @ $1.00 per ton	300,000
Coal, Other Mines	500 ,, @ $1.00 ,,	150,000
Other Goods	1,000 ,, @ $1.50 ,,	450,000
Cotton from Lunghai Rly. ..	500 ,, @ $1.50 ,,	225,000
	(Average for the year)	
Passenger Fares (Through Railway Traffic only) ..	$250	75,000
Total ..	$4,000	$1,200,000

Revenue in future will probably increase at the rate of 10 per cent in every three years.

The approximate annual operating expenses including salaries, wages, coal, sundries, Insurance, repairs and contingencies are estimated at $205,000 leaving an annual surplus of $995,000. A depreciating reserve of 5 per cent, on the estimated first cost of $4,000,000, or $200,000, to be set aside yearly, would leave a net



General Location of Nanking-Pukow Train Ferry

surplus of $795,000 per year. Over a period of seven years, the annual surplus is estimated as follows :—

ESTIMATED ANNUAL SURPLUS IN SILVER DOLLARS

Year	*Operating Revenues*	*Operating Expenses*	*Gross Surplus*	*Depreciation Reserve*	*Net Surplus*
1 ..	1,200,000	205,000	995,000	200,000	795,000
2 ..	1,240,000	205,000	1,035,000	200,000	835,000
3 ..	1,280,000	205,000	1,075,000	200,000	875,000
4 ..	1,320,000	205,000	1,115,000	200,000	915,000
5 ..	1,364,000	205,000	1,159,000	200,000	959,000
6 ..	1,408,000	205,000	1,203,000	200,000	1,003,000
7 ..	1,452,000	205,000	1,247,000	200,000	1,047,000
Total ..	9,264,000	1,435,000	7,829,000	1,400,000	6,429,000

As a further aid to those who might desire to tender on financing the work, it is pointed out that $500,000 would be required on signing the contract for preliminary foundation and other work ; another $500,000 would be required at the end of three months after starting work ; $1,000,000 at the end of six months and $2,000,000 at the end of nine nonths. Of this total, it is estimated that $1,000,000 will be spent in China on labor, etc, and $3,000,-000 abroad on materials and equipment.

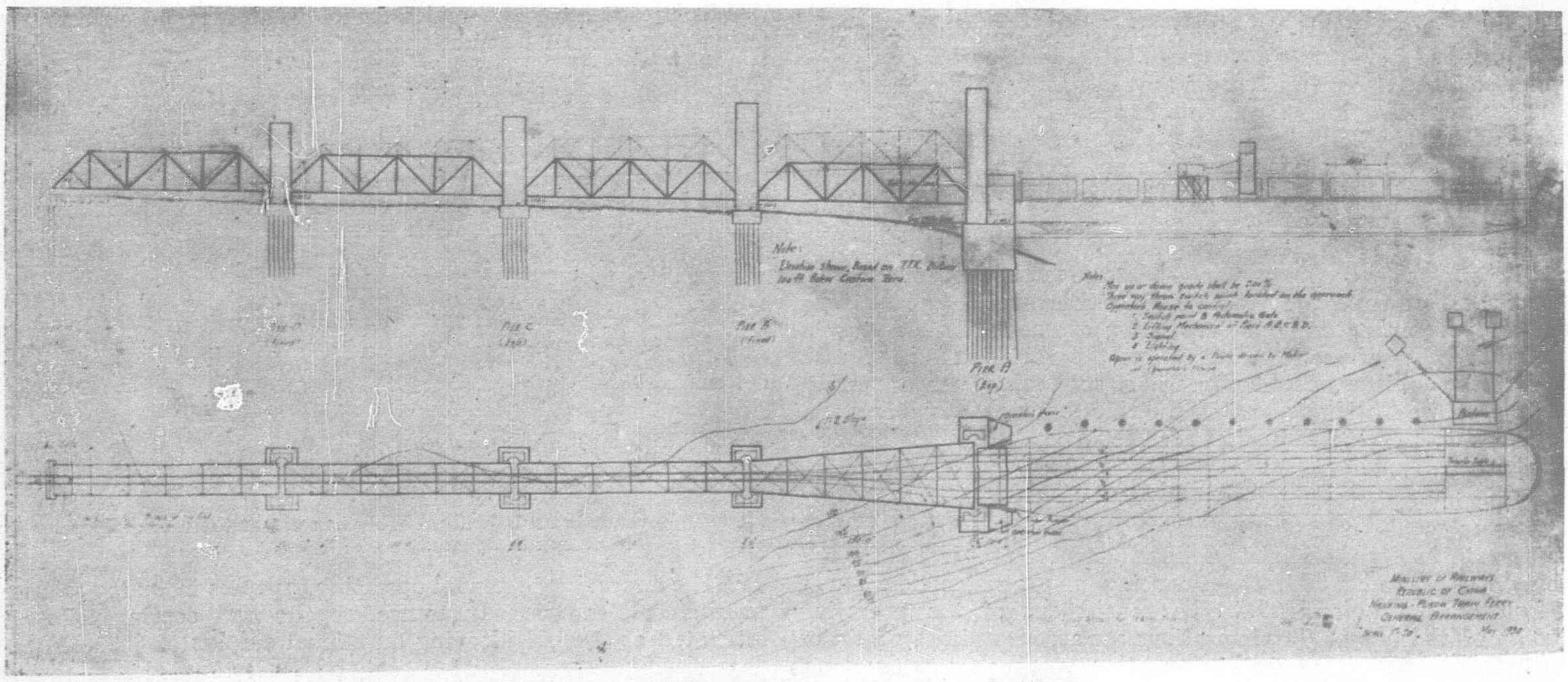
Under the first form of contract, (*a*) tenderers are invited to :—

Prepare designs for the movable steel bridges, steel towers, aprons, ferry boats and pontoons, including the necessary machinery and accessories, with detailed lists, drawings, specifications and explanatory notes, and submit quotations for the costs, c.i.f. Nanking and/or Pukow, Chinese Customs duties and taxes excluded. Time of delivery, terms of payment and other particulars are to be specified in the quotation.

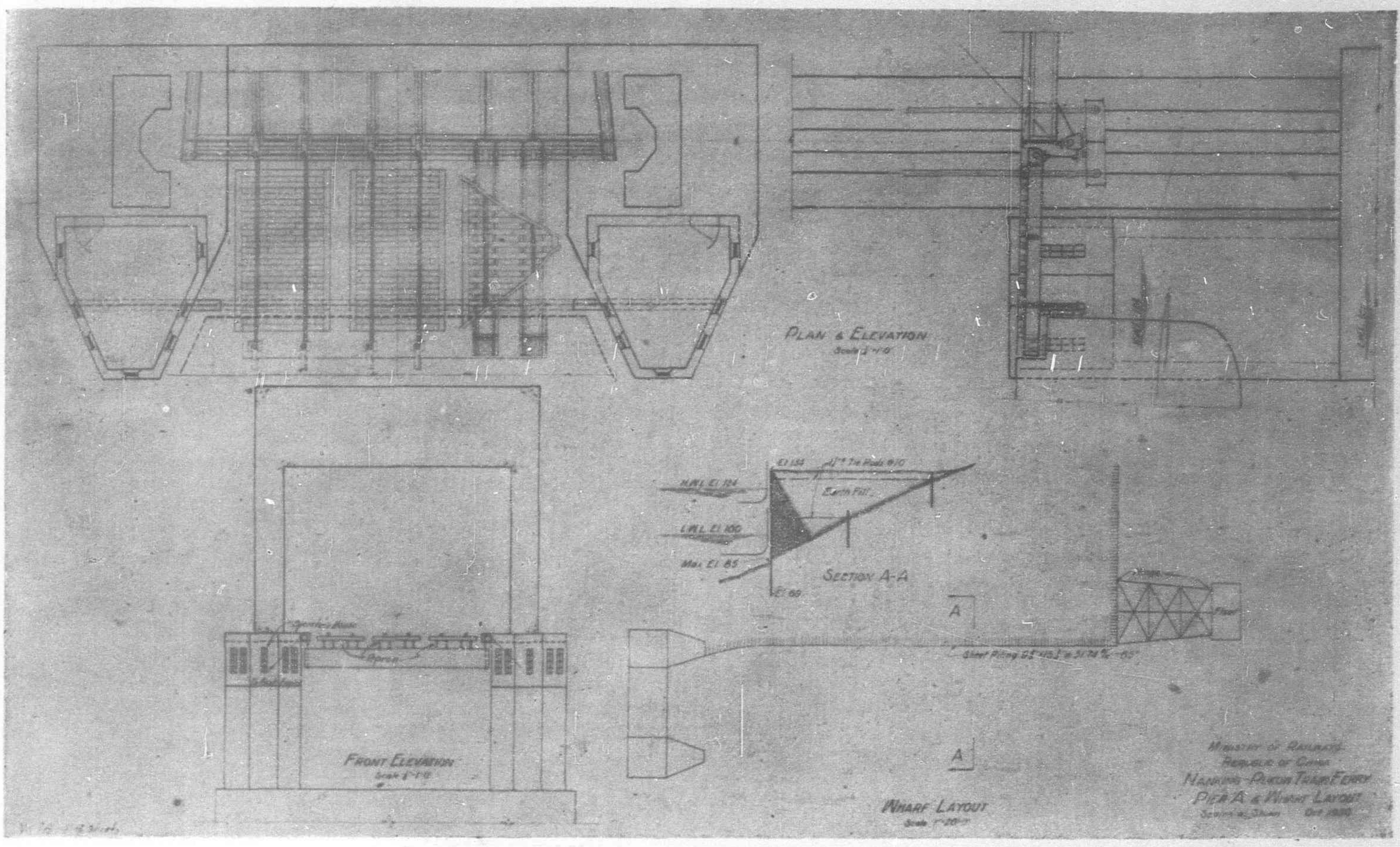
The quotations submitted are to be under three separate headings.

1. Ferry boat complete, including all machinery and other necessary equipment.
2. Bridges, steel towers, aprons, pontoons, machinery and accessories complete.
3. Erection and installation of items under 2. In this case the Ministry will arrange to provide the necessary funds.

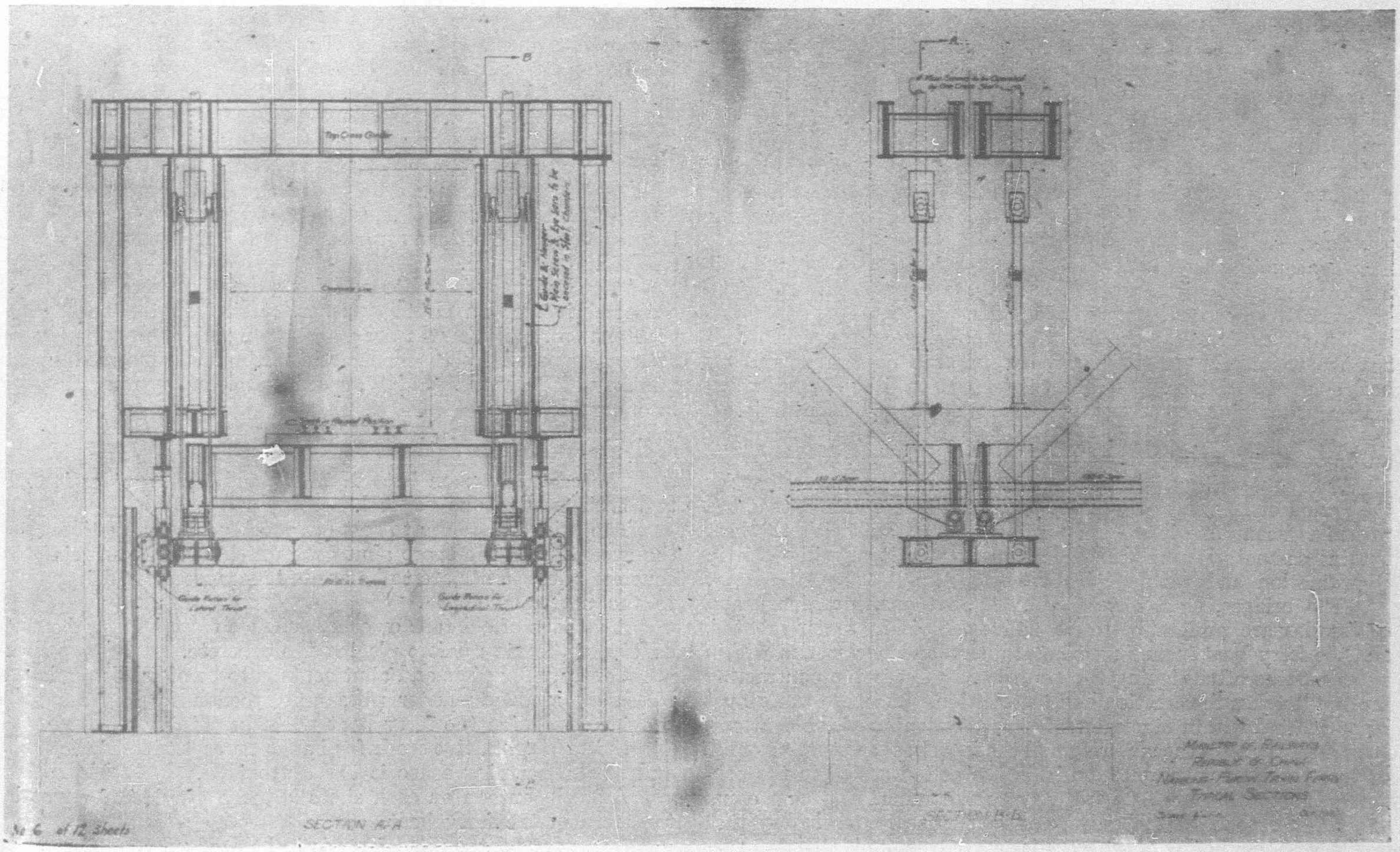
(*b*) Under this arrangement, the contracting firms will do the entire financing for supplying all the articles and materials mentioned under (*a*), as well as for the erection and installation costs, if this work is to be done by the contracting firm. In addition to this, the contracting firms will advance such sum of money, not exceeding the sum of $1,000,000 Shanghai Currency



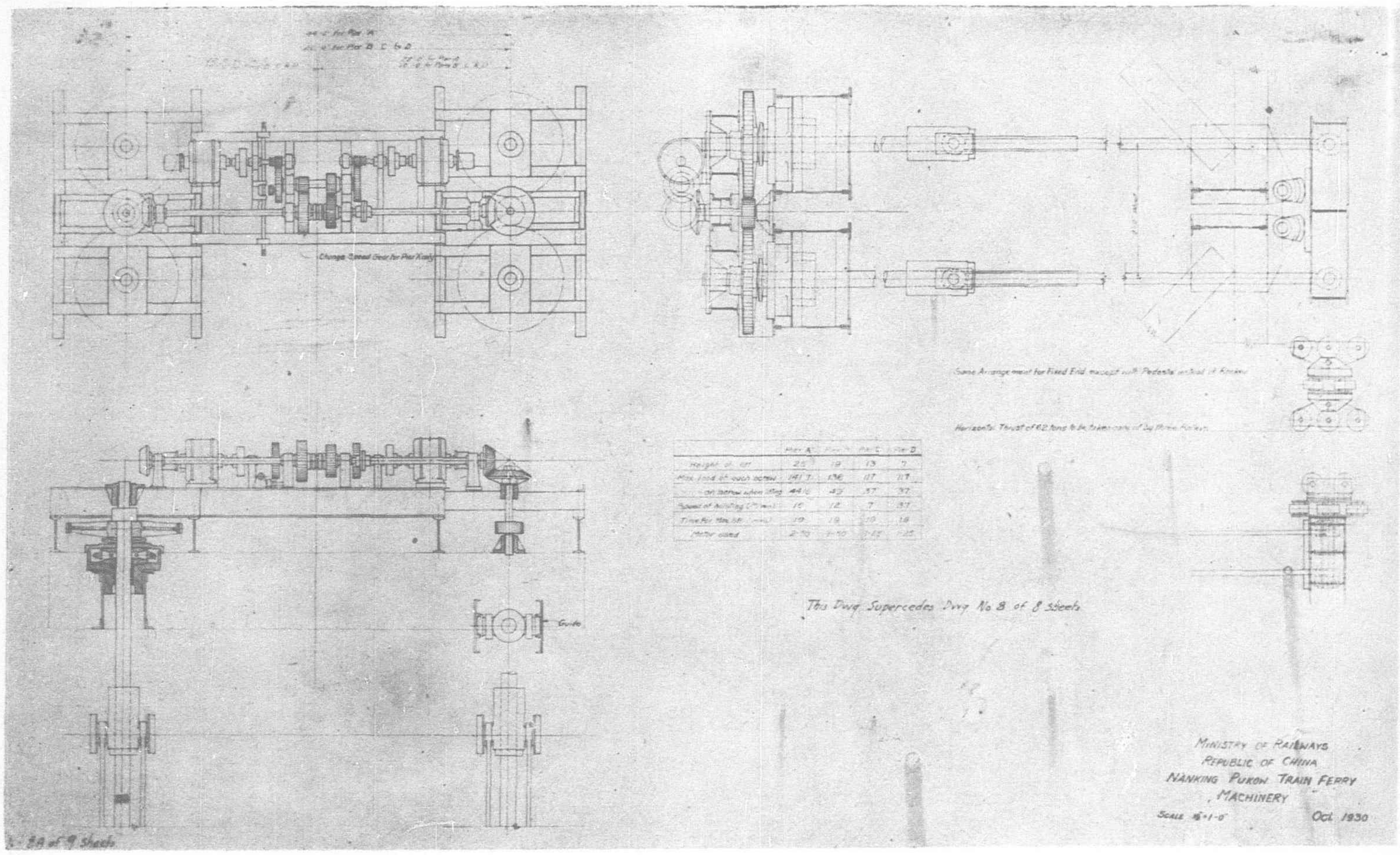
General Arrangement of Nanking-Pukow Train Ferry



Nanking-Pukow Train Ferry: Pier A and Wharf Layout



Nanking-Pukow Train Ferry: Typical Sections



Nanking-Pukow Train Ferry: Machinery

as may be required for executing the foundation and substructure. If the erection and installation is to be done by the Ministry, the cost of such work shall be included in the advance above-mentioned.

Designs for the movable steel bridges, steel towers, aprons, ferry boat and pontoons, including the necessary machinery and accessories, with detailed lists, drawings, specifications and explanatory notes must be prepared and submitted, together with quotations for the costs of these c.i.f. Nanking and/or Pukow, Chinese customs duties and taxes to be excluded. The Ministry would be prepared to furnish as security for all the money advanced a pledge of the entire works, and of the net surplus of the operating revenues.

The quoting firm is requested to mention its terms in detail for financing the whole work, such as the expected annual rate of interest, scheme of amortization, etc.

In either case (*a*) or (*b*), the two Railways concerned will arrange to acquire at their own expense the necessary land on both sides of the River. All the work relating to piling, foundations, masonry, dredging and shore protection will be done by the Ministry.

Inspection of materials used for fabrication will be made by an Inspecting Engineer appointed by the Ministry.

The contracting firm is required to furnish a guarantee for the period of 12 months from the time of the acceptance, that the work has been done in a workmanlike manner and with the best obtainable material and that each and every item will work in co-ordination and with efficiency.

The bridges, steel towers, aprons, pontoons, machinery and accessories are preferably to be delivered within seven months, and the ferry boat including all machinery and accessories within eight months after signing the contract. In case the contracting firm undertakes the erection and installation, the entire work must be completed within nine months after the signing of the contract. In case any or all of the materials and the ferry boat are not delivered, or the work is not completed within the period stated in the contract, the contracting firm will pay to the Ministry a sum equal to 1/10 per cent. of the entire contract price for each day that delivery or completion of the work is delayed, as liquidated damages and not by way of penalty.

The essential features of the contract are as follows :—

The train ferry between Nanking and Pukow is to provide for carrying passenger and freight trains across the Yangtze River which has an extreme variation of water level of 24 feet throughout the year and a daily tide variation of one to three feet during the low water season. Provision, however, must be made for abnormally high or low water and therefore allowance for an extreme variation of 28 feet should be made.

The connection between each shore and the ferry is to be made by four bridges, each of 150 feet span, with adjustable ends which can be raised or lowered to suit the variation of water level. The variation of deck level on the boat when loading and unloading is to be taken care of by a movable apron, 20 feet long, at the outer end of the last span.

The shunting of cars to and from the boat is to be done by a locomotive, or an electric pusher, carried on the boat, or by capstans and cables on the boat, and/or on each shore, or any other system proposed by the contracting firm and approved by the Ministry of Railways. Safety, speed and economy must be taken into consideration.

Foundations and Substructure

The earth slope on both Nanking and Pukow sides is to be two horizontal to one vertical.

The bridge piers are to rest on wooden pile foundations, with the exception of the shore abutment which is to be on reinforced concrete piles. Piles are to be accurately placed and driven down to the necessary depth.

A grillage of old rails or other suitable material is to be made on top of the piles before placing the concrete.

Concrete for piers and abutments is to be of 1: 2½: 5 mixture. Necessary wooden cluster piles and wooden fenders are to be provided to guide the ferry boat when berthing.

Suitable protective work for banks on each side of the bridge and at the berthing space is to be provided.

A steel pontoon on each shore is to be provided for mooring the stern of the ferry boat.

Space for pontoon and ferry is to be dredged to 15 feet below lowest water level.

Steelwork and Machinery

The eight 150 feet spans are to be designed for Cooper's E35 loading with full impact. There will be three tracks gauntleted on the bridge. The three-throw switch points are to be located on shore while frogs are to be on the outermost span, which flares out to allow for three tracks spaced 12 ft. center to center. Rails 85 lb. per yard with necessary fastenings and crossings on the bridges are to be provided by the Contracting firm.

The Chinese Government Railway specifications shall govern all details concerning the bridges, unless otherwise specified. Eye-bars, pins, main screws and nuts shall be made of nickel steel, properly heat-treated and pins shall be case-hardened. Gearing shall be arranged so that the four spans can be raised or lowered simultaneously at a proportionate speed. Provision must be made to allow movement of the outer end of river span independently for slight adjustments when loading and unloading take place. Worm gearing, properly designed and approved by the Ministry, may be used instead of spur gearing.

The machinery is to be designed so that the outermost end of the bridge can be raised or lowered not slower than one foot per minute. The necessary motors, wirings and fixtures for working the movable bridges, as well as the wirings and fixtures for adequately lighting up the bridges and the berthing space shall be provided by the contracting firm. The existing power plants on both sides of the River have a line voltage of 380, with 50 cycles and 3 phase. Automatic and electrically operated gates, to close the entrance to the incline at the shore end of the bridge, are to be provided by the contracting firm. These gates will be always in closed position when the ferry boat is not in secure contact with the apron. The gates are to be interlocked with switch points leading to a catch siding with sand track on the shore.

The three-throw switch points leading to the bridges are to be interlocked with signals and gates. They are to be electrically controlled in the operator's cabin. All the interlocking work mentioned in this Article and Article 12 will be done by the Railways concerned.

Indicators are to be provided in the operator's cabin and on individual towers to indicate the movement of the various spans.

Toggle bars or some other device are to be provided to connect the ferry boat with the apron.

Besides electric operation, proper means are to be provided for hand operation of the bridges and the apron whenever necessary.

Ferry Boat

The boat is to be built to Lloyd's highest classification, and must pass the usual trial test. On the deck there shall be three railway tracks of standard guage, each with a clear length of 300 feet. The center to center distance of adjacent tracks is to be 12 feet. Rails 85 lbs. per yard, with necessary fastenings are to be furnished by the contracting firm.

The freight train to be carried will consist of twenty-one loaded cars of 40 ton capacity, each car having a length between couplers of 42 feet and a tare of 18 tons. The passenger train to be carried will consist of 12 coaches, each 72 feet between couplers.

The boat is to be designed to carry a total live load of 1,200 tons plus the weight of a shunting locomotive if carried on board. Allowance is to be made for overloading to the extent of 50 tons. The boat is to be able to carry three locomotives, one on each track, at the same time, these locomotives to have axle loads of 20 tons each, the axles being spaced five feet apart.

The boat is to be self-propelling and to have a speed of 12 knots in still water. When the boat is fully loaded, the top of rail is to be 12 feet above water level.

The difference of draft of the boat when fully loaded and when with no load shall preferably not be more than two feet.

Life rafts, belts and buoys are to be provided sufficient for 500 persons. Boilers are to be so designed to use bituminous coal for fuel. The boat is to be equipped with necessary machinery, wirings and fixtures for adequate electric lighting with the same voltage, cycle and phase as on the bridges.

Living quarters are to be provided for officers and crew on the boat. In case shunting of cars is done with a locomotive carried on the boat, a transfer table 42 ft. long is to be provided at the stern end to enable the locomotive to operate on the three tracks. The power required to operate the transfer table is to be provided on the boat. The shunting locomotive is not to be provided by the contracting firm. In case the shunting locomotive is not used on the boat, each track shall be 342 feet long. In case an alternate system is used, such should be included in the quotation. Provisions are to be made to securely fasten cars to the tracks on the ferry boat.

Ferry boat is to be designed with a single bottom, and sufficient number of water tight bulkheads are to be provided. Necessary equipment, such as life boats, anchors, chains, portable repairing tools, pumps, etc, etc., are to be supplied and clearly specified in the quotation submitted.

Cause and Effect

(Continued from page 661).

Nanking is suspicious of anything that smacks of outside intervention and with good reason. If it now rejects any offer of assistance which carries with it foreign interference in its administrative independence, even temporarily, it is difficult to censure her. Much will depend upon the outcome of Chiang Kai-shek's present campaign to suppress the Communist and Bandit armies that infest whole provinces. If, within the next six months or even a year, these hordes can be disarmed and there continues a real understanding between Nanking and Mukden, China will need no help from the outside. If, on the other hand, Chiang fails and is weakened by his campaign to an extent that Mukden, following the time honored traditions of Chinese warfare, should take advantage of his position to extend its rule and power, then the future is black indeed.

Chiang Kai-shek says that China has fought her last civil war. Chang Hsueh-liang has sworn renewed allegiance to Nanking. Everything is the color of the rose. The outlook is bright and hopeful. Two or three years of peace under an honest government with the revenues of the country flowing into the National Treasury and Nanking will require no assistance from without and all talk and discussion of possible intervention, benevolent, humanitarian or otherwise, is superfluous.

G. B. R.

Political Parties in China

(Continued from page 665).

"The question is on the lips of nearly everybody, how long can the Kuomintang rule can last in China. To be frank, the Kuomintang rule cannot last very long in its present state of affairs. For no public organization built on nepotism can endure for any length of time. Nor could a government 'without the consent of the governed' be very lasting. . . . Under the circumstances, the most sensible thing for the Kuomintang men to do is immediately to call a parliament or a People's Conference as outlined by the late Dr. Sun. Short of this, the present oligarchy in Nanking will eventually collapse like a house of cards."

One conclusion arrived at after reading these two books, is that the day of the foreign propagandist in the employ of Chinese governments is over. The Chinese are now quite competent to fight their own political battles in the press and in the welter of give and take, the real truth about conditions in the country will be exposed by themselves.

The impression is gained that as long as the present régime in Nanking continues to function without recognizing the Left, it will be subjected to an intense propaganda abroad that will counteract its own publicity. In Mr. Liang's acknowledgment of assistance in the preparation of his book, there is a list of names which indicate clearly that the Leftists in China have the powerful support of some of the foremost publicists and moulders of public opinion in Europe, whose influence will be exerted to block any scheme to strengthen Nanking under its present leadership.

It is regrettable that this should be so, for although Nanking is by no means perfect, yet with all it's shortcomings, it represents a distinct advance over the old order of things and it is to be hoped that the split in the Kuomintang can be patched up and a real unification brought about in order to avoid a recurrence of the insensate struggle for power which has brought ruin and misery to millions of peace loving people.

G. B. R.

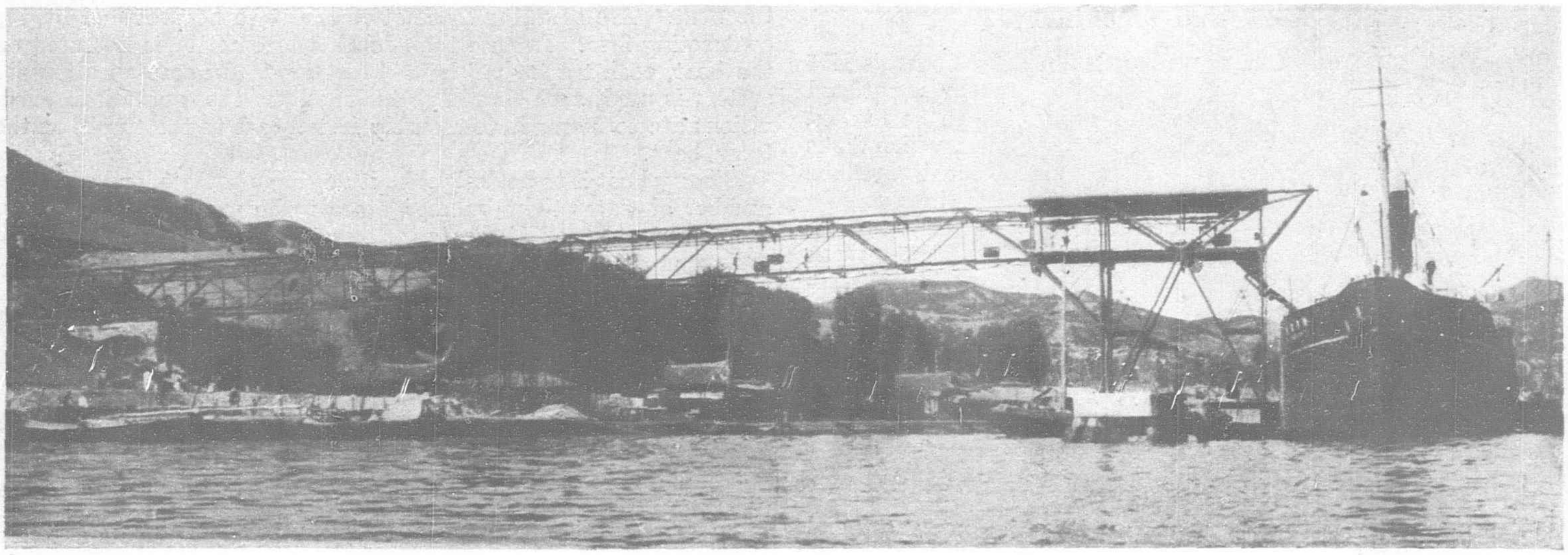


Fig. 4.—Loading Station and Chute

A New Suspension Trackway for Loading Iron Ore in the Harbor of Shako, Korea

By Prof. RITARO HIROTA, Tokyo

JAPAN started at an early period to introduce improvements in mine transportation. The first single-line cableway was erected as far back as 1889 on the property of the Ashio copper mine, for carrying the dressed ore over the mountains to Nikko, whence it was forwarded to the market at Tokyo either by cart or by rail. At the time this was the shortest route.

This cableway, supplied by the firm of Takata & Co., was designed and built according to the Hallidie system by the Roe & Bedlington Co., of London. As was customary under the little-developed engineering conditions then prevailing, an expert engineer was sent from London to superintend erection. This first cableway had a length of 3,600 m. (12,000 ft.), a greatest difference in levels of 495 m. (1,630 ft.), and a differential elevation between terminals of 145 m. (475 ft.). The capacity per hour was about three tons.

A few years later, a second cableway of about the same capacity was built, to be followed by a number of other single-line cableways in various parts of the country. The first two-cable line was constructed in 1901, again by the Takata firm, according to the designs and specifications of the firm of Adolf Bleichert & Co., A.-G., of Leipzig.

Bleichert two-line cableways were in the sequence supplied to the Ashio, Besshi, and Hidachi mines, and to the Imperial Steel Works in the province of Yechigo. The last-mentioned cableway, however, has not been erected thus far, it having been found necessary to bring up the ore from other points.

In recent years, cableways have come into wide use in Japan for transporting purposes, as is evidenced by the fact that a single Japanese engineer, Mr. Y. Tamamura, has constructed single and double lines of a total length of over 750 km. (450 miles). These cableways usually serve in the transportation of materials over ridges and valleys in mountainous territories. In no case, however, had such a cableway—or what is essentially the same thing, a rope-operated suspension trackway—ever been used for loading ships in sea or river ports. In one case, proposals for the employment of a cableway for coaling ships were in fact declined by the manager of one of the largest collieries.

The first Japanese enterprise in this direction, a new rope-drawn monorail trackway near Shako, a northern port in Korea, has proved eminently successful. The general plan of the trackway resembles the loading plants on the island of Elba and of the Vivero iron mines in Spain. The trackway was built for loading ore from the "Rigen" mine into ocean-going ships. It was put into operation in October 1929, and has ever since been working to the complete satisfaction alike of the owners and the steamship companies. Loading costs have been lowered, while the waiting time of the vessels in the harbor is shortened.

The "Rigen" iron mine is situated in the North of Korea. Formerly, the ore was carried by a small-gauge railway over a distance of 3 km. (1.8 miles) to the shore, and thence taken to the harbor by lighters. Later on, the Government built railway-sidings for the company both to the mine and to the harbor, whereby the ore was enabled to be taken to Shako harbor direct over a railway stretch of 12.7 km. (7.8 miles) length, to be stored in large bunkers on the shore.

The ore bunkers each have eight compartments of a combined total capacity of 5,000 tons. It was to connect these bunkers with the steamers that the Bleichert rope-operated trackway has been installed. The ore is conveyed in ropeway carriers of standard design with box hangers. They run on monorail tracks and are moved by an endless traction rope. The carrier boxes are

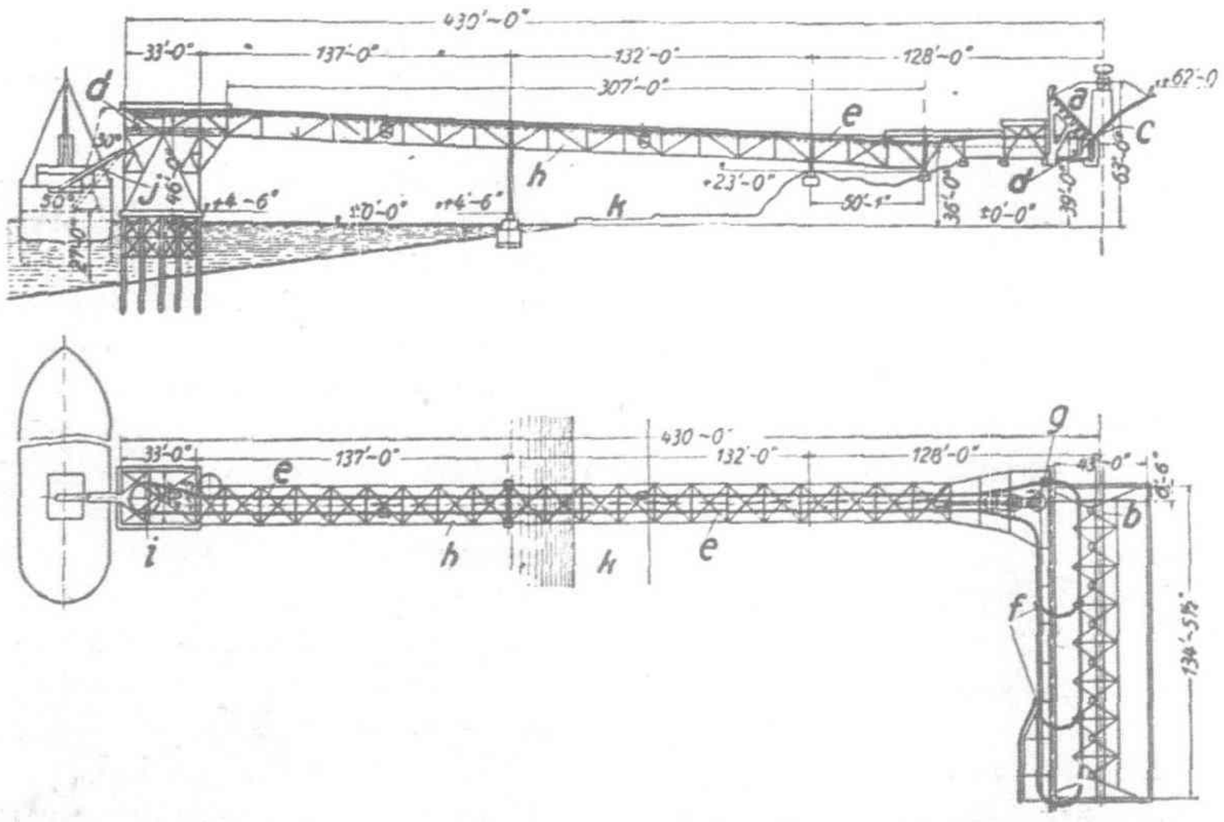


Fig. 1.—Plant and Elevation of Shiploading Plant in the Harbor of Shako, Korea

(*a*) Ore bunkers
(*b*) Railway track for bunkers
(*c*) Discharge spout in ore bunkers
(*d*) Box of ropeway carrier
(*e*) Suspension-track rail
(*f*) Switch
(*g*) Weighing machine
(*h*) Loading bridge
(*i*) Cable return pulley
(*j*) Delivery chute
(*k*) Road

automatically tipped and emptied in passing around the return pulley, the discharged ore dropping into a hopper from which it runs into the ship's hold through a chute. As may be seen from the sketch of Fig. 1, the line between the ore bunkers and the pier has a length of 130 m. (430 ft.) and a gradient of 3.6 per cent. The monorail tracks are supported in a lattice girder. Each carrier has a capacity of 1,125 kg. (2,500 lb.) of ore. The cars run in time intervals of 20 seconds, at a traction-rope speed of 1.25 m. (4.1 ft.) per second. A Diesel engine is used for the drive.

The plant has an output of 200 tons per hour. As has been mentioned, it was designed by the firm of Bleichert, which was also charged with its erection. Although the personnel is as yet not completely trained to the work, the saving in time and expense brought about by this improved method of handling the ore has been so large as to leave no doubt from the very beginning about its complete superiority. Worthy of particular note is the fact that this first trial of a novel method of loading vessels was made in a small and unknown port in Korea, and that it operated satisfactorily from the very first day. This success must be credited to the bold and wise action of the management of the Rigen Iron Mine Company in following the recommendations of their consulting engineer, Dr. S. Niwa of the Sanyo Civil Engineering Office at Tokyo.

Surrounded as it is by the sea on all sides, Japan is likely to find many more places within its confines where loading plants of this kind, of greater or less size, may be advantageously put into operation. Such cable-operated trackways are suitable for loading loose materials, such as coal and ore, as well as sacked and other piece goods. While due caution is commendable in the introduction of new devices, the successful experiment at Rigen is likely to have a decisive influence in advancing the materialization of similar enterprises.

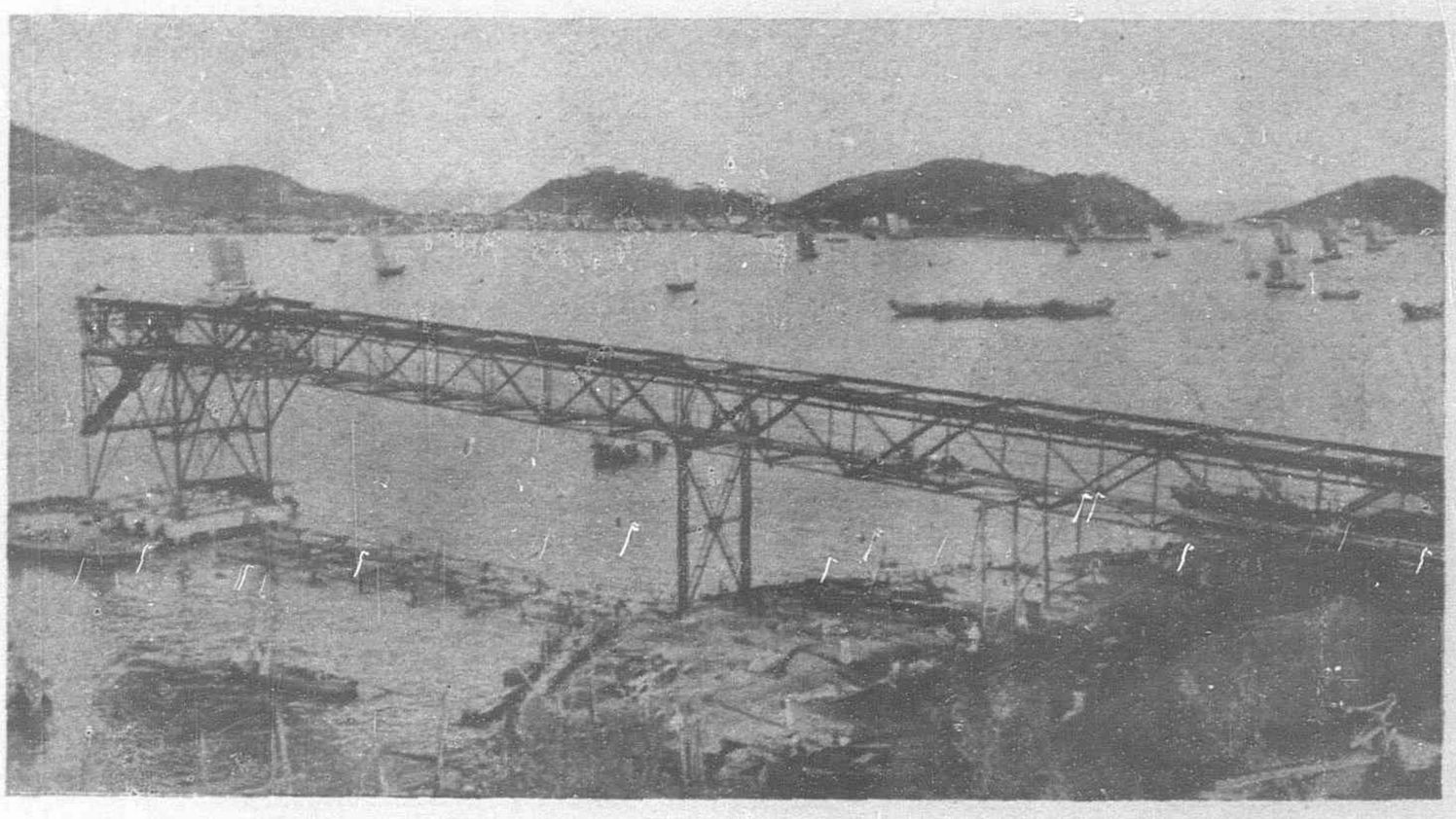


Fig. 3.—Trackway and Bridge, View from Ore Bunkers

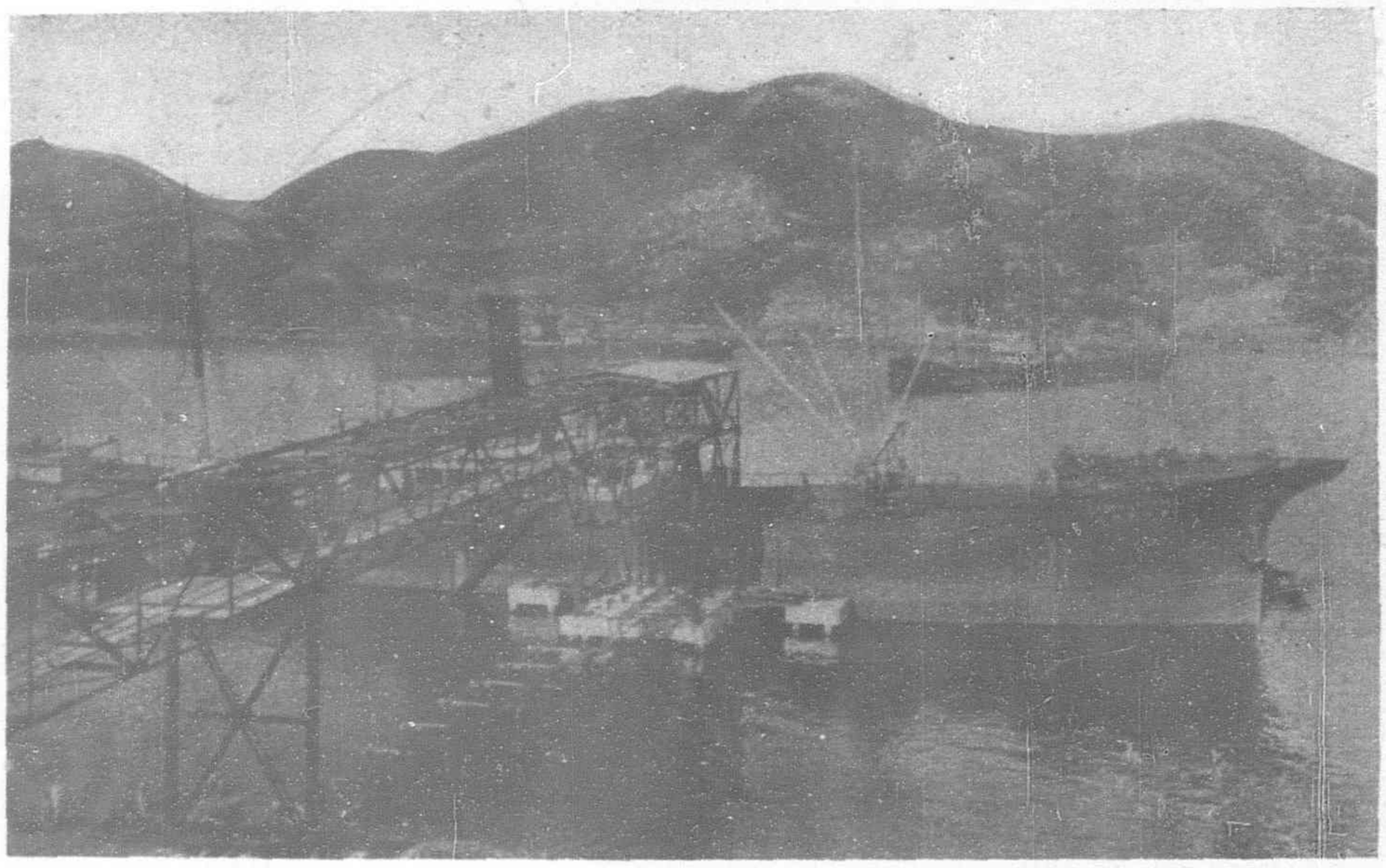


Fig. 2.—Freight Steamer "Niitake Maru" (3,400 Tons), the First Vessel to be Loaded with Ore, on October 10, 1929

British Engineers' Association

Classified Handbook for 1930

This valuable classified compilation of British manufacturers of engineering plants and materials is indispensable for all buyers of engineering products. It's object is to establish a closer contact between Buyers Overseas and the Engineering Firms members of the Association. As practically every British engineering firm of repute is included in the membership, the handbook becomes not only a directory and guide but a guarantee of service and reliability in executing orders.

The objects, activities and services of the British Engineers' Association are fully described in the handbook, copies of which will be mailed on request to all Buyers of Engineering products and others interested in British engineering industry. The British Engineering Association's address is 32, Victoria Street, London, S.W. 1.

EDGAR ALLEN STAG TUBE-MILL :—The second edition of the Edgar Allen Stag Tube-Mill pamphlet has been considerably enlarged and is now a comprehensive publication of 30 quarto pages. The pamphlet opens with a section on tube mill grinding, describes the Stag combination tube mill and other types of tube mills, and winds up with a description of the centra-drive method of driving combination mills and tube mills. The pamphlet is elaborately illustrated, and contains many reference tables and facts of importance to those interested in grinding and crushing machinery.

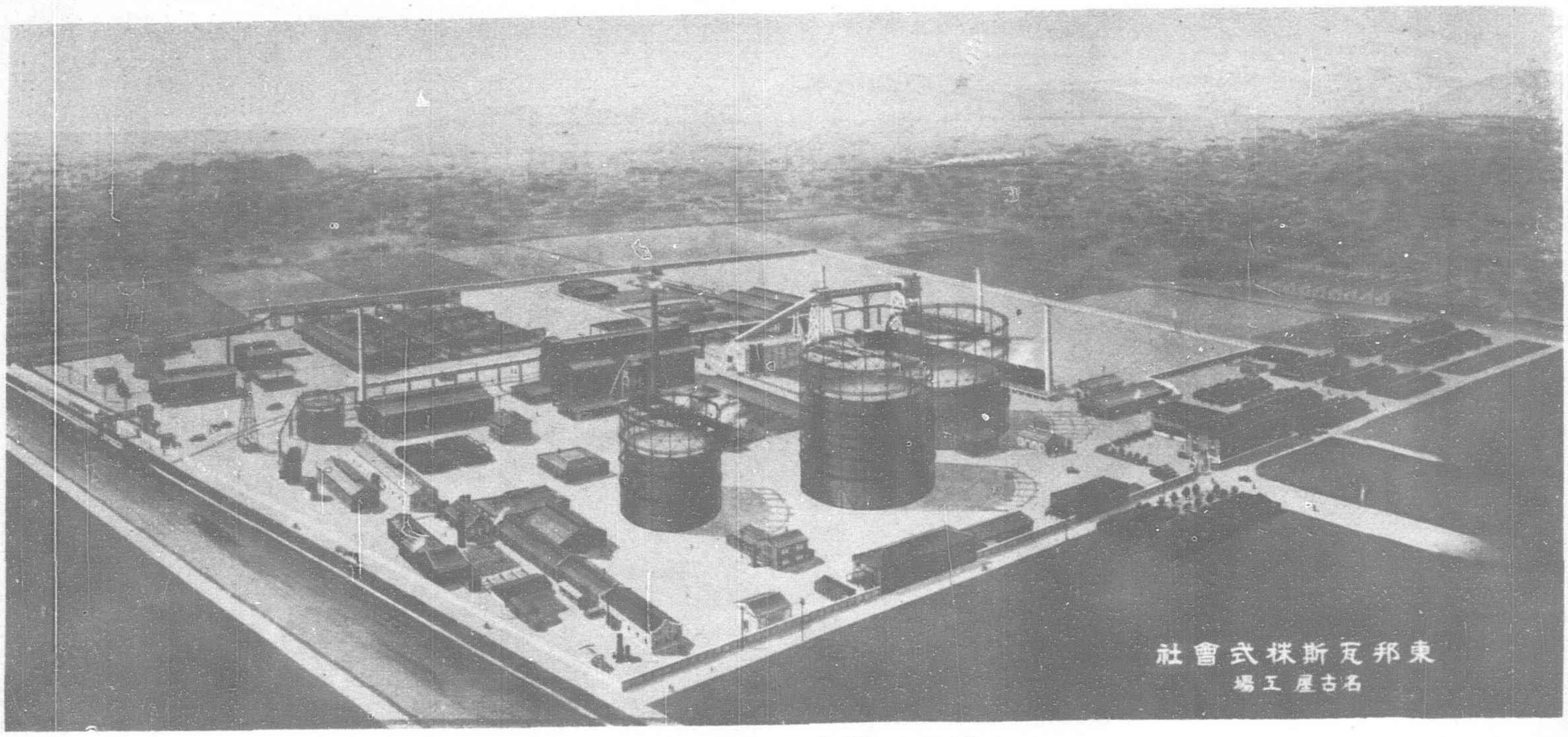
SKINNER'S COTTON TRADE DIRECTORY, 1930-31.—The eighth issue of Skinner's Cotton Trade Directory, the standard work of reference of the Cotton Industry maintains its high standard of usefulness. Substantial efforts have been made to still further augment the information contained therein. A large number of names have been added and valuable additions have also been made to the particulars previously published. With a view to providing up to date details of the Cotton Trade, Messrs. Thomas Skinner & Co. in order to publish information received too late to be included in Skinner's Cotton Trade Directory.

In addition to the usual circulation the "Mill Supplies Section" has been bound separately for the personal use of the mill managers. In like manner the "Fabrics Section" has been bound separately for free distribution to potential buyers of Cotton Piece Goods. As circumstances demand, other Sections will be dealt with in a similar manner.

New Paper Mills

Marshal Chang Hsueh-liang is planning to raise capital amounting to $2,000,000 for the erection of a paper mill with motive power derived from the Sungari waterfalls.

Chairman Kao-chiyi (of the Northeastern Communications Commission is also planning to establish a new paper mill in Liaoning Province on the capital of $1,000,000.



The Toho Gas Company's Plant at Nagoya

Gas in Japan and the Far East

By WALTER T. DUNN, M.I.MECH.E.

BEING present in Japan attending at Tokio the recent World Engineering Congress and the Tokyo Sectional Meeting of the World Power Conference, I took the opportunity of examining fully the position of the gas industry in the island empire. As Secretary of the Institution of Gas Engineers for 32 years I have been closely associated with the gas industry of Great Britain, and have been able thereby to make friends with gas engineers also in distant parts of the world. This circumstance resulted in my having special privileges granted through which I could obtain first-hand information. Traditional Japanese courtesy was extended to me everywhere, especially at the gasworks which I visited during the course of my extensive tour. The respective engineers readily supplied me with the particulars which are here collated. The information gathered through the introductions of my friend Mr. S. Okamoto, Engineer and Director of the Toho Gas Company, an amalgamation of a number of gas undertakings, materially assisted me in the preparation of this Paper.

Since 1874 all the most important cities, and even country districts, have been connected with a system of gas supply. Gas came to be employed not only for heating purposes, but for lighting. It was soon recognized as an excellent servant in the kitchen, in the bathroom (Japanese people are remarkable for their cleanliness), and for application to power service.

At the present time, however, it is noticeable that the use of gas for the purposes of illumination is diminishing; indeed now only about 50 per cent of the gas manufactured is used for lighting, compared with the volume used for lighting in the year 1916. Gas for lighting at first superseded petroleum lamps in domestic dwellings but was not employed for lighting the streets. Gas in Japan has never been adopted to the same extent for lighting as it has been in Europe. For heating, it continues to become more and more popular, as is also the experience in Europe.

Some idea of the dimensions and growth of the Japanese gas industry may be gathered from the statement of the length of the mains. In the year 1922 the total length of gas mains laid throughout the empire was 5,867,448 metres (3,633.8 miles). At that time gas was used in 552,367 homes, and the annual consumption was 12,206,342,642. cubic feet. Five years later, in 1927, the corresponding figures were :—total length of mains 8,442,505 metres (5,228.6 miles), an increase of about 44 per cent ; the number of homes supplied was 853,688, an increase of 73 per cent ; while the gas consumption rose to 17,284,500,000 cubic feet, equivalent to an increase of 42 per cent.

For the year 1926 the average consumption in each home, and per head of consumer, was as follows for the six principal cities of Japan :—

	Per Head	*Per House*
Tokyo	2,754 cubic feet	25,462 cubic feet
Asaka	821 ,,	15,041 ,,
Nagoya	1,258 ,,	16,664 ,,
Kyoto	1,350 ,,	18,647 ,,
Kobe	1,726 ,,	16,421 ,,
Yokohama	490 ,,	11,988 ,,

Taking the above figures, the average per head works out at 1,388 cubic feet, and the average per house 17,370 cubic feet. In the British Isles for the year 1929 there were 9,448,648 consumers, and the annual make was 318,509,000,000 cubic feet. In twenty years the annual make has increased by 65.3 per cent.

Compared with the year 1912, when the average consumption in Japan was 9,778 cubic feet, the figure of 17,370 cubic feet for 1926 shows that the consumption of gas per house has doubled in the course of a period of fourteen years.

Turning now to the financial aspect of the matter, the total capital invested in the gas industry of Japan in the form of paid-up capital, loans, debts, etc. amounted in 1926 to Y.178,000,000 (the value of the yen is approximately two shillings). That amount represents the capital invested purely for the purposes of gas production ; but if there be taken into account the capital funds employed for collateral business, the total reaches more than 700 million yen (£70,000,000). If we compare this sum with that invested in other Japanese enterprises it is found that Y.328,253,212 are invested in spinning mills ; in paper mills Y.208,136,451 ; and in sugar refineries Y.207,238,000. The importance of the gas industry of Japan will thus be appreciated. The shipping industry is the fifth in the order of importance. It has a total amount of invested capital of Y.167,172,700. The gas industry has attained the position of third on the list. These figures are given by the Hypothec Bank of Japan and relate to the year 1926.

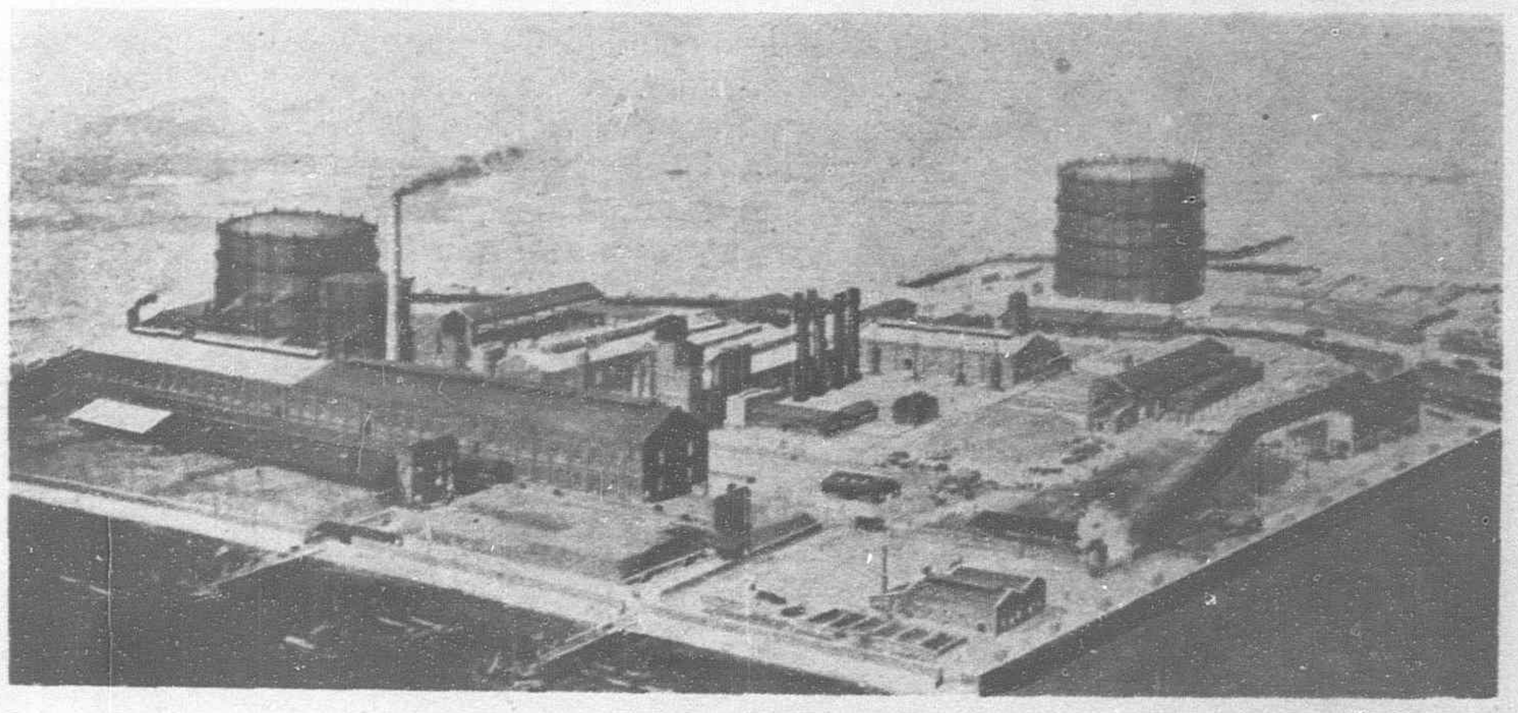
It has to be added that, for work not then commenced an amount of Y.520,000 had been set aside. There are also gasworks existing in the Japanese colonies of Korea, Formosa, etc, the paid up capital relating to them being Y.6,775,000.

In regard to the prices charged for gas I found that they vary widely in the various cities. There is no standard price. The average price is about Y.3 (say 6 shillings per 1,000 cubic feet). Although the system of charge is not by the term, steps are now being taken to introduce that British system, which was brought into being by the Gas Regulation Act 1920. An English gas engineer has been engaged to furnish the data required, and his report has been submitted.

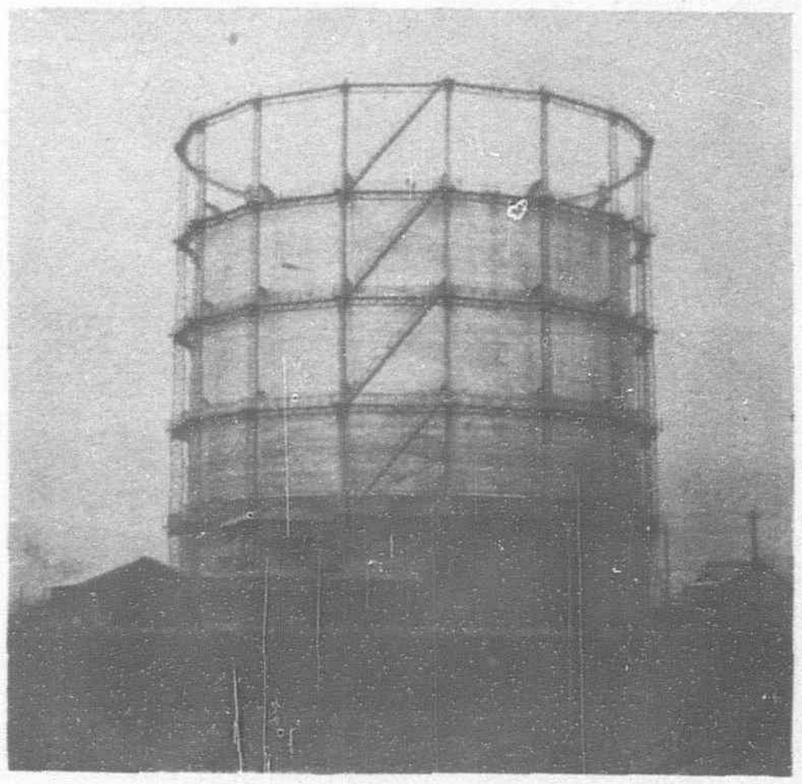
If the total consumption of gas in Japan be taken as 17,184,500,000 cubic feet selling at Y.51,550,000, and the total capital be taken at Y.186,000,000 the result is a gross income of about 30 per cent. There can therefore be no question that the Japanese gas industry is in a flourishing and stable condition.

Quite recently the price reduction movements for electric lighting and electric cooking and heating, have resulted in the public availing themselves of electricity to the detriment of the gas undertakings. With a courage which is characteristic of the Japanese, a very large advertising scheme was launched in 1928. The effect has been entirely satisfactory. It has arrested the declining tendency of gas statistics, and has been the means of further popularizing the advantages of gas as a clean, hygienic, inexpensive and reliable commodity.

But the gas industry of Japan, like that of Great Britain, suffers from unfair legislation, which acts as a brake to progress. In this country the administration of gas concerns has to be conducted under obsolete Acts of Parliament. In Japan gas companies may not pay more then 12 per cent dividend per year. It is being paid to-day by many companies, but at Tokyo, and at Osaka (the "Manchester" of Japan) I was informed that an agitation is in progress for the lowering of gas charges, although 12 per cent in Japan is not regarded as an excessive return. It may therefore be assumed that the average dividends in future will be somewhat lower. Wherever I went it was apparent that gas is popular, serving the people of all the principal cities and country districts.



Plant of the Kobe Gas Company



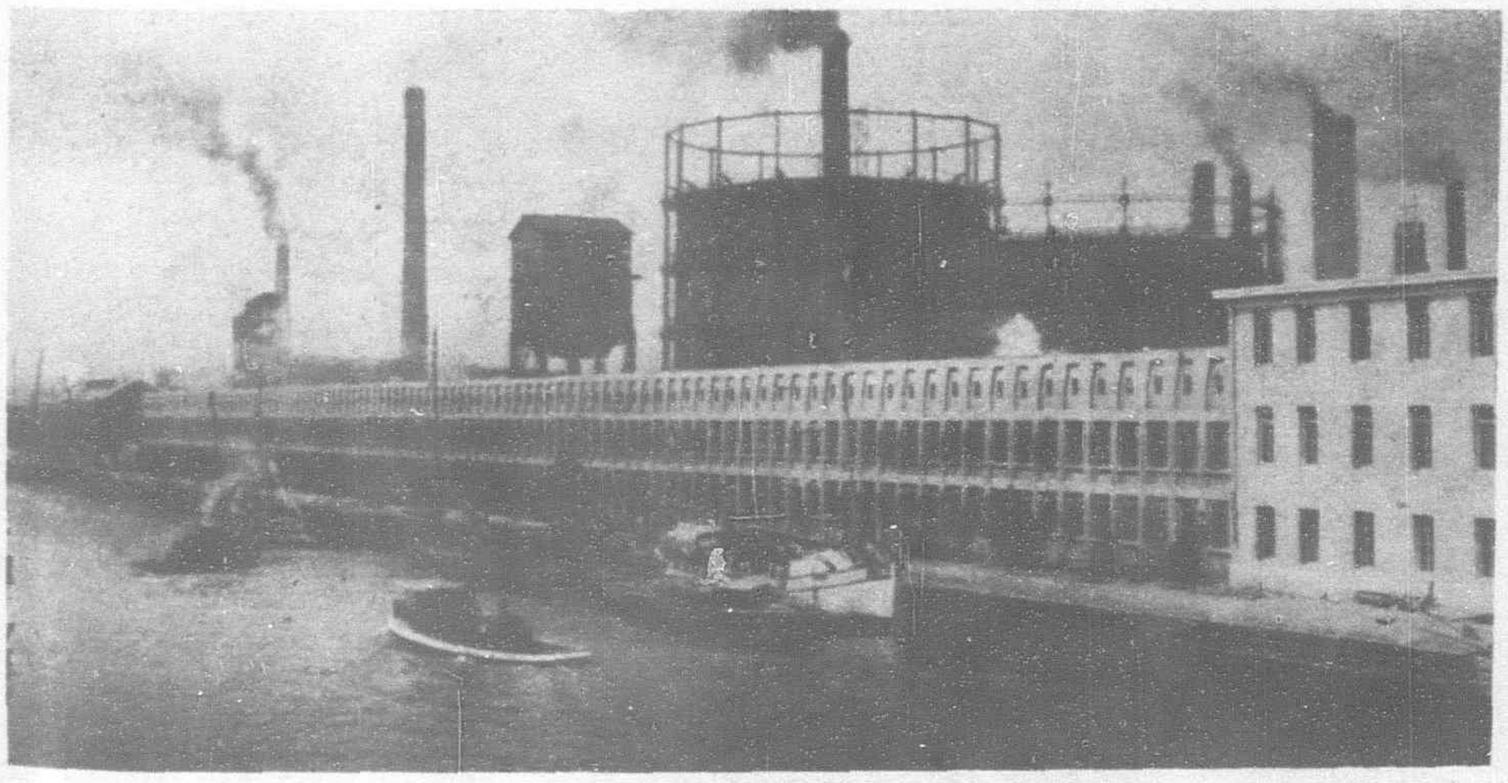
Gas-holder of the Osaka Gas Company

Tokyo

The Tokyo Gas Company was founded in the year 1895 with a capital of Y.270,000,000. An amount of Y.100,000,000 has been paid up. Recently the expenditure of the sum of Y.50,000,000 was decided upon for extensions, but the scheme proposed was rejected by the City Authorities. The Company supplies the city of Tokyo, the municipal prefecture, and some parts of the neighboring ancient prefectures of Kanagawa and Saitama. Five gasworks have been erected in various parts of the district. Their daily production is over 44,400,000 cubic feet. There are thirteen gasholders having a total capacity of 29,200,000 cubic feet. One of them is o. the waterless type; and another one of that type is under course of erection. I had the opportunity of seeing it and going inside to examine the method of its construction.

During the year 1928 the Tokyo Gas Company bought from neighboring undertakings 450,845,800 cubic feet, and supplied to its consumers 4,469,741,150 cubic feet. Of coal 235,952 tons were carbonized. The number of meters installed for domestic and other uses was 456,360.

At Tsurumi I was shown over the new works for the Tokyo Gas Company, which it was hoped to bring into commission early this year. It will have a total producing capacity of 150,000,000 cubic feet. The gasholders will be capable of containing 10 million cubic feet. The plant consists of ovens, coke Woodall-Duckham vertical retorts, and a carburetted watergas installation. One was reminded of the Beckton Works of the Gas Light and Coke Company where at the present time a very large coke oven plant is being laid down, the cost of which will be in the neighborhood of a million pounds sterling.

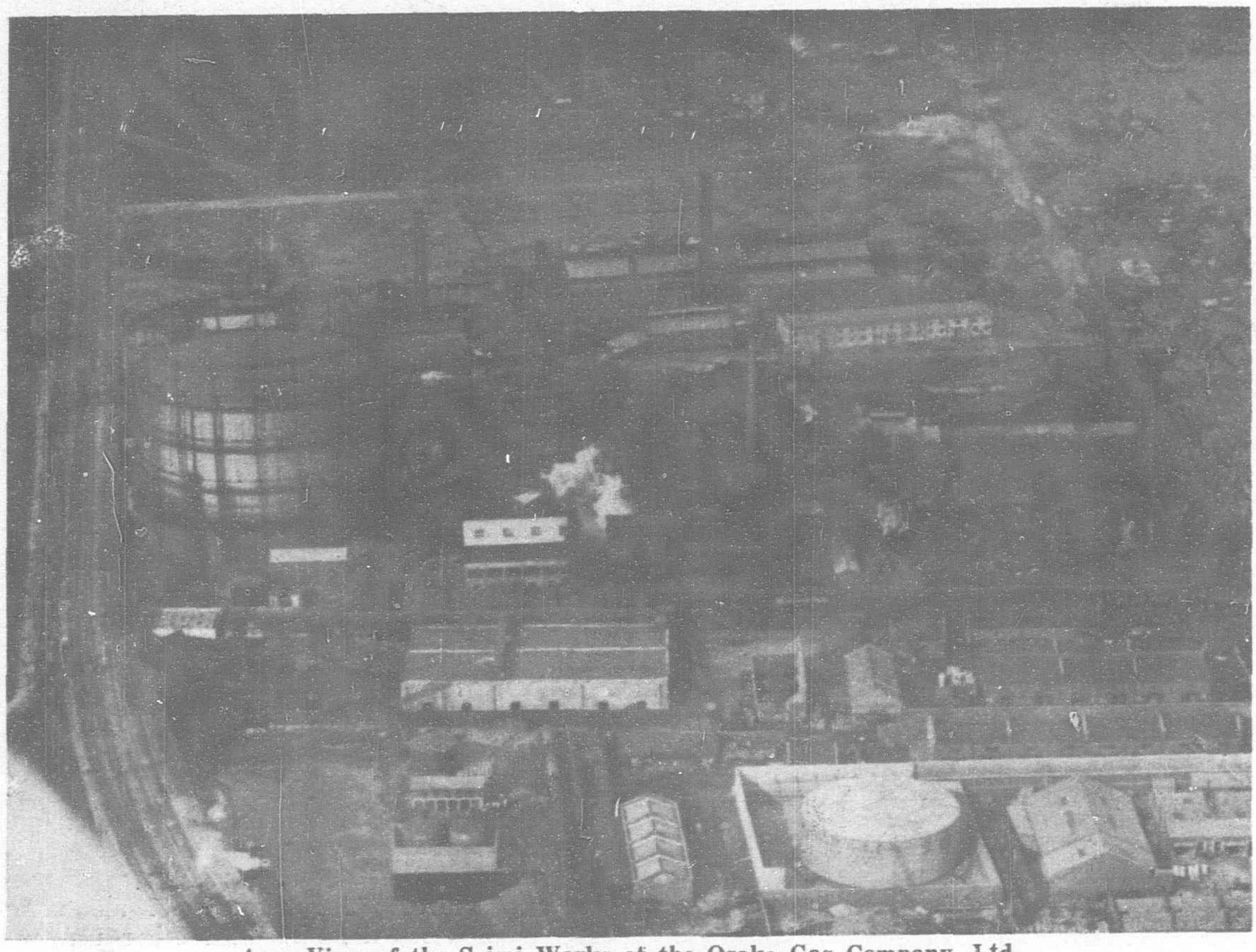


Main Plant of the Osaka Gas Co., Ltd.

As to the Woodall-Duckham plant at Tsurumi, various sections of it were being delivered when I visited the site. The most up-to-date improvements in this well-known pioneer vertical retort system have been introduced. Its co-inventor Sir Arthur Dukham, G.B.E., gave a paper at the World Power Congress describing it. In introducing the subject the author stated that the present-day gas engineer, faced with the problem of increasing his carbonizing plant, had before him a number of different systems from which to make his choice. The four main types of carbonizing plant used in gas works to-day were probably continuous vertical retorts, horizontal retorts, intermittent vertical chambers, and coke ovens.

A study of the technical literature brough t out the fact that all four systems had undergone striking developments during the past ten years. Continuous vertical retorts, by impro ve

ments in design and methods of construction, could give larger outputs of gas per square foot of ground space, higher yields of gas per ton of coal, and lower fuel consumption, than could the plant of five years ago. Horizontal retorts, with a development of silica construction, improved charging machinery, and larger charges, could show lower costs of gas production than were obtainable a few years ago. Intermittent vertical chambers, which were a



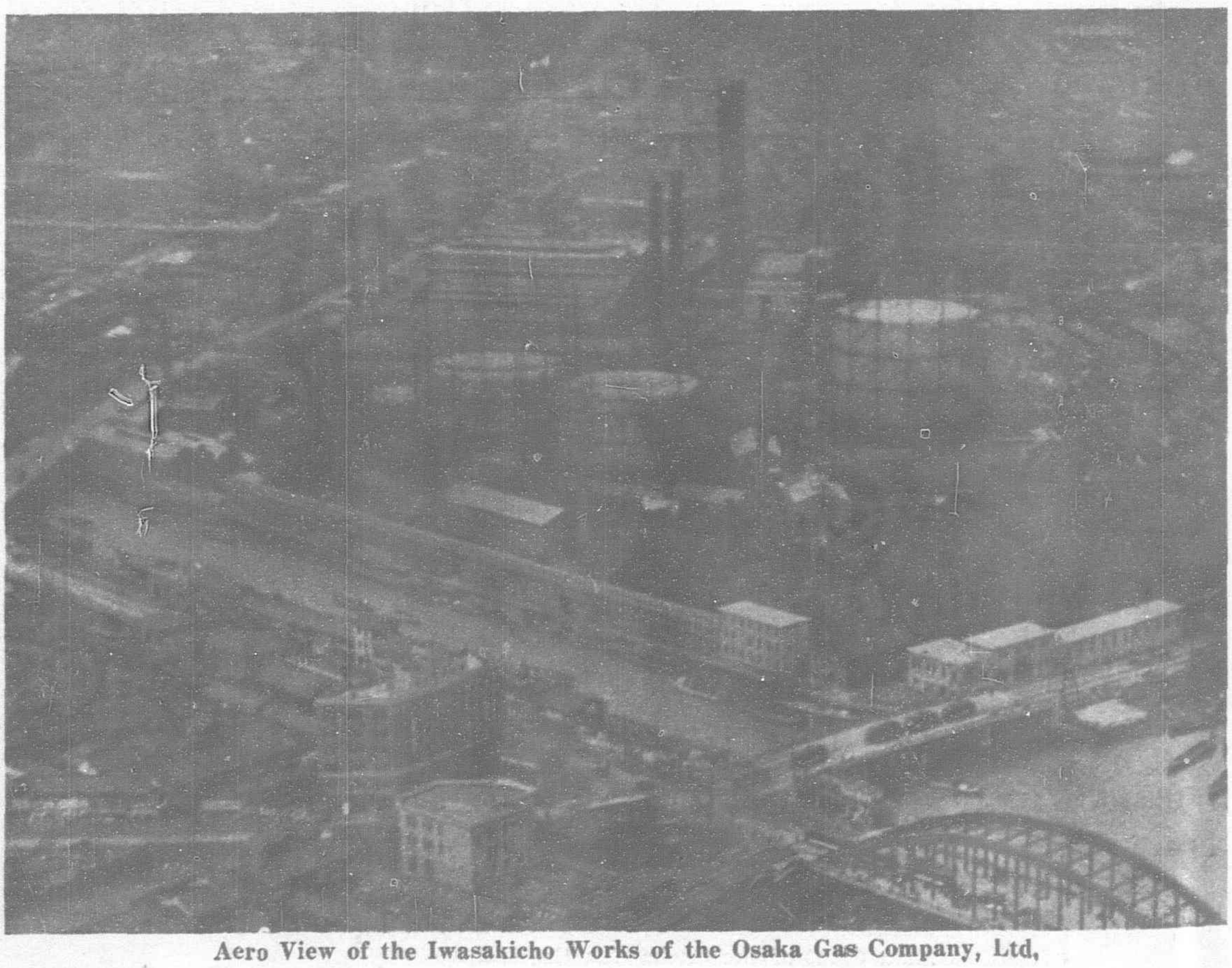
Aero View of the Seimi Works of the Osaka Gas Company, Ltd.

natural development of the Dessau intermittent retorts, were making rapid progress, by reason of their high thermal output per ton of coal, high output per square foot of ground space occupied, and low maintenance costs.

Coke oven construction has fundamentally altered by the development of the large silica quick-coking ovens with the necessary adjunct of even heating. With four progressive systems of carbonizing plant it would appear at first sight that a gas engineer was faced with four equally suitable propositions. If however a census were to be taken of the extensions to the carbonizing plants of gas works in Great Britain during the past five years it would be found that over 95 per cent were in the form of either continuous vertical, or horizontal retorts. Sir Arthur suggested that in the past there had been too great a tendency for fashions in carbonizing plants, whereas the fact of the matter was that in every individual case of reconstruction, or of extension, the best type of plant should be considered afresh. For any particular scheme it would be usually found that one particular type of plant was most suitable to meet the local requirements.

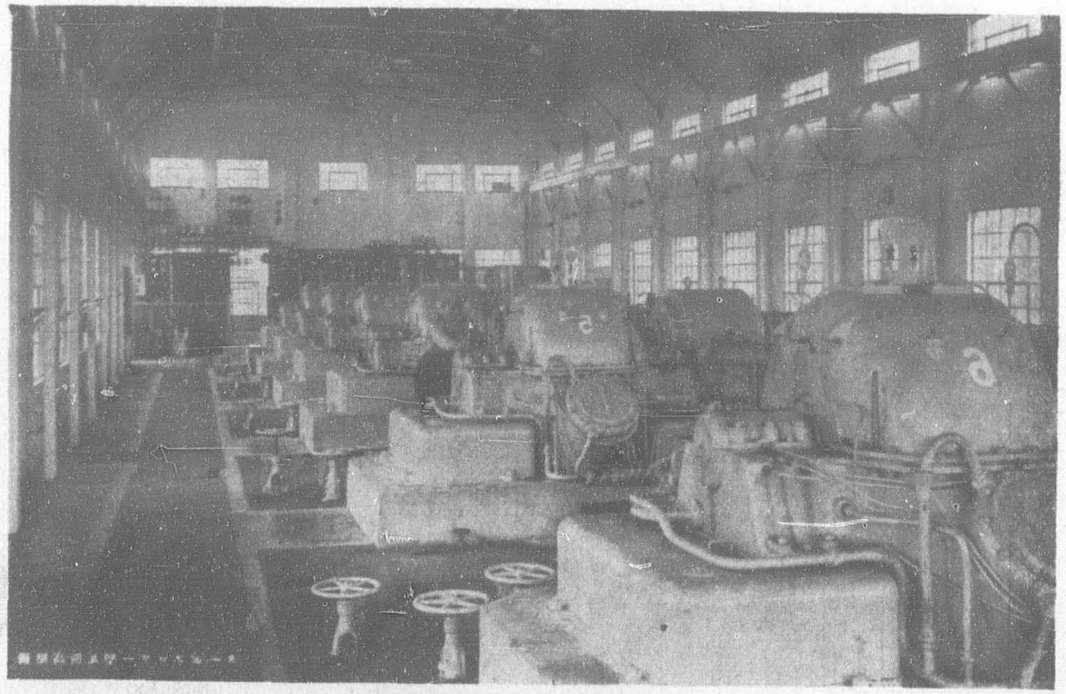
The characteristics and applications of the four main types of carbonizing plant available for modern gas works were reviewed. Dealing with coke ovens it was shown that the economics of operation of a coke oven plant depended to a large extent on size. The modern quick-coking oven had a high output per day. A battery comprising a small number of ovens had to bear an excessive capital charge in the pushing and charging machinery. Coke ovens had less flexibility as regards output and calorific value than had other forms of carbonizing plant. Therefore except in the case of large undertakings, which could ensure the continuous operation of a reasonably sized battery of ovens at full load, and which were sure of their disposal of coke, coke ovens did not come within the usual consideration for gas work extensions. In the large majority of extensions of carbonizing plant there would appear to be three main systems to be considered, *viz.* (I) Horizontal retorts; (II) Continuous vertical retorts; (III) Intermittent vertical chambers.

With modern machine-charged horizontal retorts the labor costs were similar to those of both continuous vertical retorts and intermittent vertical chambers. But without machine-charging, horizontal retort carbonization had a much

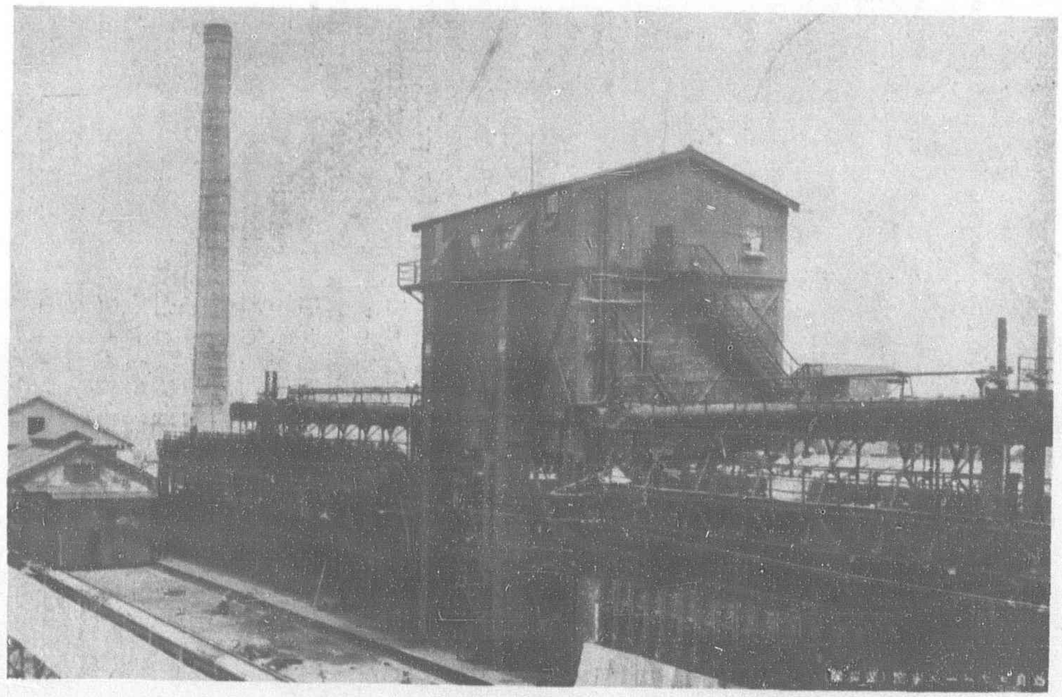


Aero View of the Iwasakicho Works of the Osaka Gas Company, Ltd,

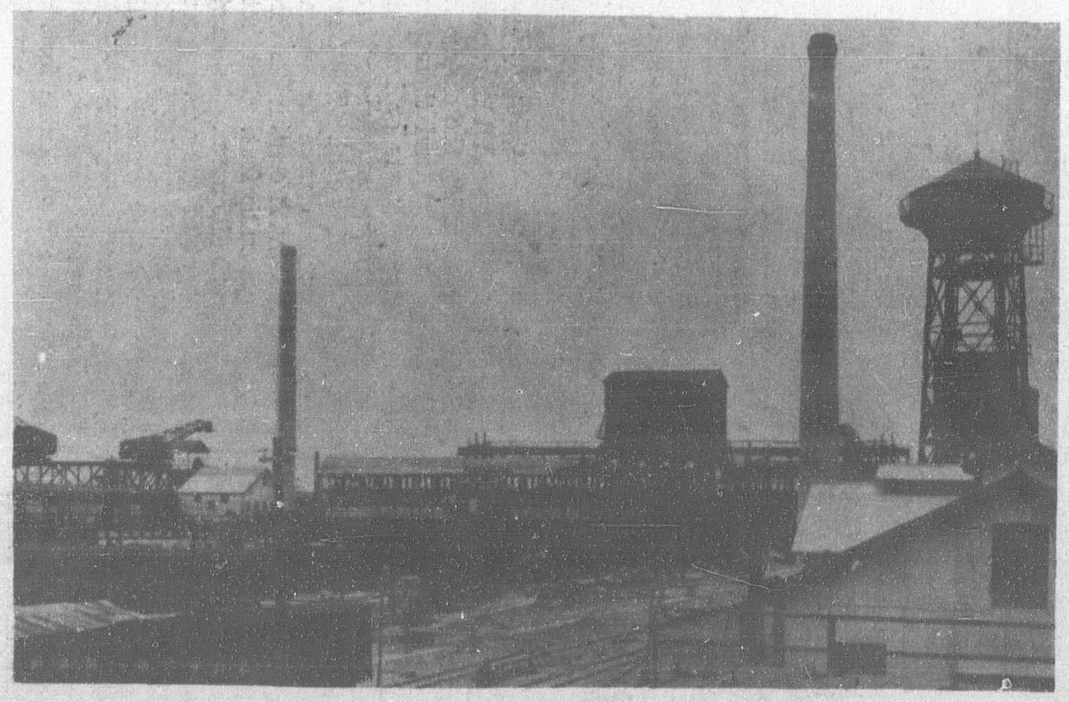
TSURUMI PLANT OF THE TOKYO GAS CO., LTD.



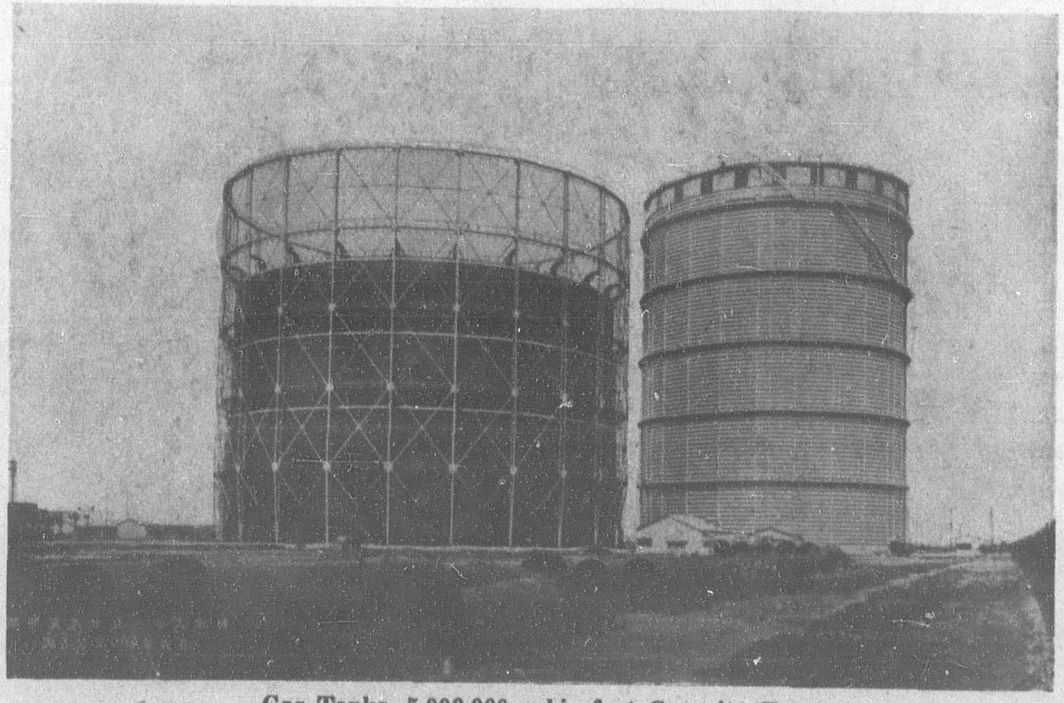
High Pressure Turbo-Blowers



Coke Ovens



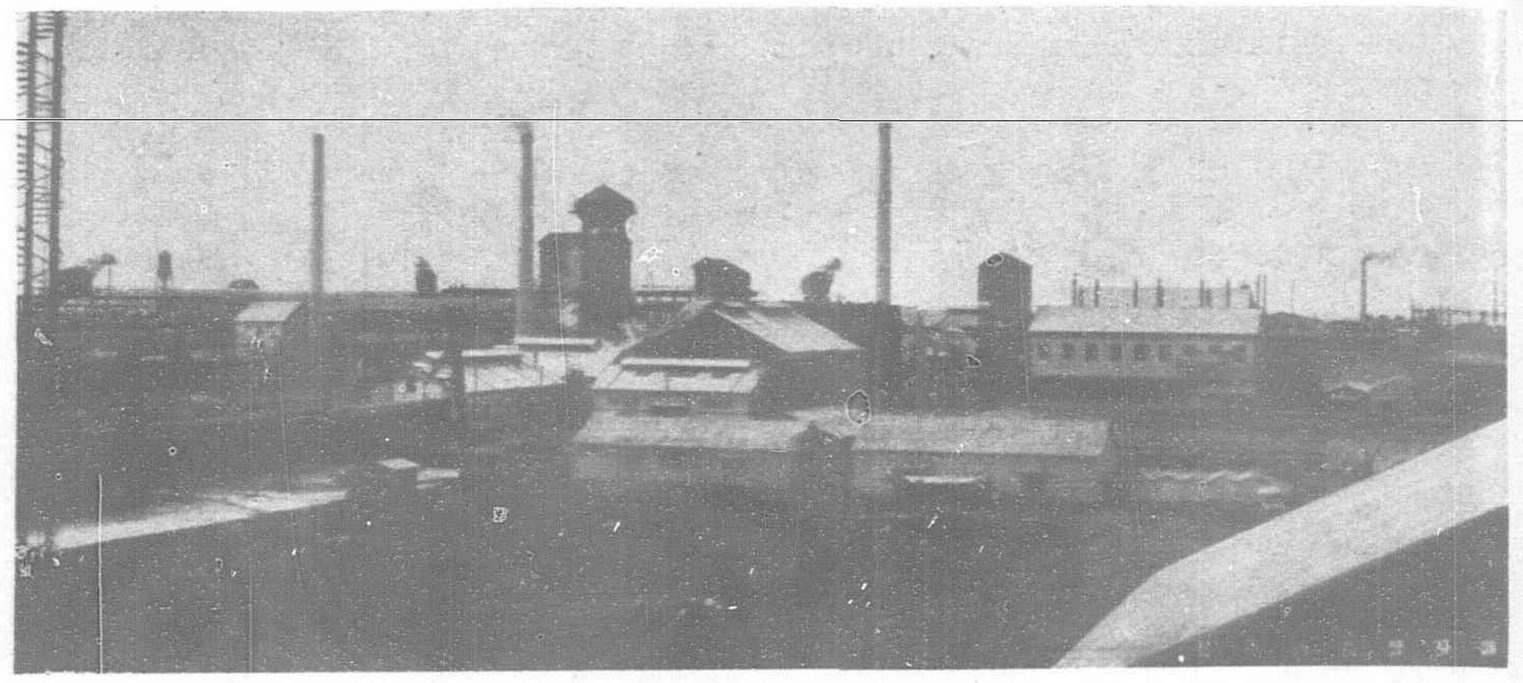
Coke Ovens



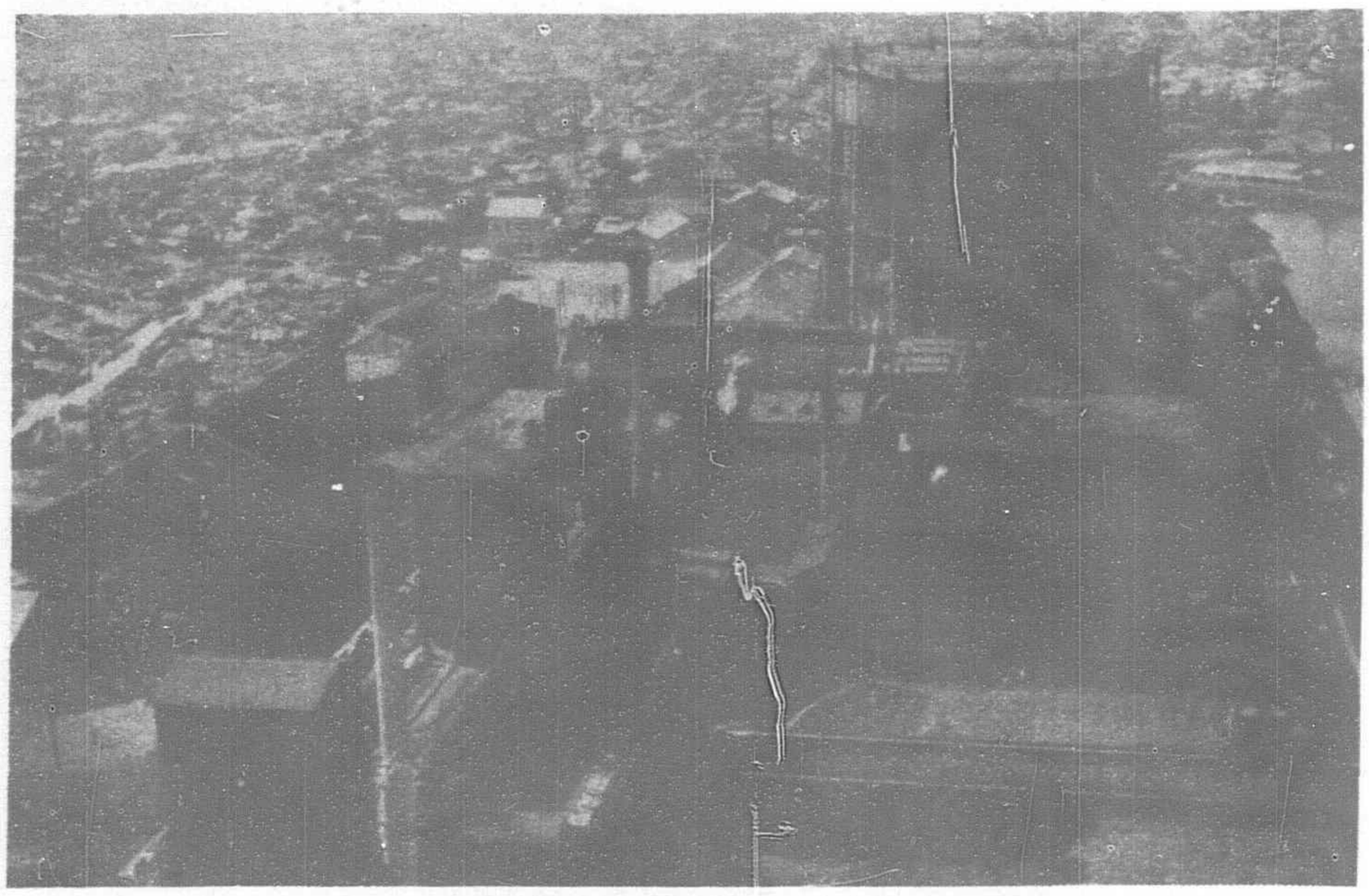
Gas Tanks, 5,000,000 cubic feet Capacity Each

greater labor charge. Even with a very small unit of continuous vertical retorts the charging and discharging devices were the same as for the large plant, but with a small unit of horizontal retorts the charging machinery became a proportionately greater item of expenditure.

Thus with a small installation of horizontals one was faced with either high capital charges, or high labor charges, per ton of coal carbonized. The output of gas per square foot of ground space, an important factor in these days of increasing demand for gas, was greatest with continuous vertical retorts; was closely followed by intermittent vertical chambers; and then by machine-charged horizontals. Modern continuous vertical retorts could produce nearly three times as much gas per unit of ground



General View of Tsurumi Plant of the Tokyo Gas Co., Ltd.



General View of the Omori Works of the Tokyo Gas Co., Ltd.

space as could modern machine-charged horizontal retorts.

Referring to the advantages of the continuous vertical retort from the point of view of heat conservation, the advantage appeared to be in favor of continuous vertical retorts over either intermittent vertical chambers or horizontals, for the following reasons :—(I) In both intermittent vertical chambers, and in horizontal retorts, the coke was discharged from the chamber or retort in a red hot condition, whilst the coke from continuous verticals was discharged cool; (2) In both intermittent vertical chambers, and in horizontal retorts, the offtake temperatures of the gas leaving the retorts were higher than those from continuous vertical retorts. Further, with the introduction of the therm basis of charge in Great Britain, under the Gas Regulation Act 1920, there was a great tendency to supply a mixed gas.

There were two ways of doing this : either by making a straight gas in the carbonizing plant and mixing it with blue water gas made in an external generator : or by steaming the charge in the carbonizing unit. Horizontal retorts did not lend themselves to steaming, but either continuous vertical retorts or intermittent vertical chambers, could be operated to make gas over a wide range of calorific value with an average gas-making coal. The economic limits with intermittent vertical chambers were approximately 560 to 470 B. Th. U's. per cubic foot. With continuous verticals the limit were 550 to 400 B. Th. U's per cubic foot. But between these two systems there was an imporant difference. When steaming an intermittent chamber the output of gas was appreciably less than when making straight coal gas, but with a continuous vertical retort the output remained constant, or was even slightly increased. Thus for a given daily output of gas with intermittent vertical chambers, the lower calorific value of the gas to be made, the greater became the capital cost per 1,000 cubic feet. With continuous vertical retorts, when a gas of lower calorific value was to be made, there was no marked difference in the capital cost per 1,000 cubic feet.

In the case of a gas undertaking where the calorific value was already established, suitability of the plant for producing gas of the required quality was of great importance. Thus for calorific values above 520 B. Th. U's per cubic foot, horizontal retorts, or intermittent vertical chambers with low steaming, were especially applicable. For calorific values of 520 to 470 B. Th. U's., either intermittent vertical chambers or continuous verticals were suitable, with the balance progressively in favor of continuous verticals as the calorific value fell to 470 B. Th. U's. Below 470 B. Th. U's. the continuous vertical retort was the most efficient plant.

In the paper on "Vertical Retorts," which I gave to this Institution in 1925, I traced the evolution of the Woodall-Duckham system, and members may be referred to that paper for information. The invention was the result of the unremitting labors of Sir Arthur Duckham and Lt. Col. H. W. Woodall, both of whom at the time were in the service of the Bournemouth Gas and Water Company. The first experiments were carried out at the works of the Company in November 1903, which was the date of the original setting. It was followed in 1904 by a plant put to work in September of that year. The retort was 20 feet long, and was oval in section, the dimensions being 24 by 10 inches at the top and 24 by 18 inches at the bottom. The third plant constructed worked for about twelve months in the year 1905-1906; those retorts were 20 feet long, and were oval in section, 24 by 10 inches at the top, and 27 by 20 inches at the bottom. They were heated by the gases from three combustion chambers which were directed round the retorts in a descending direction. In designing this plant simplicity of construction was aimed at; one feed-roll served two retorts, and all mouth pieces and top ironwork were carried clear of the brickwork, the joints being made by the spigots of the mouthpieces fitting into the sockets on the retorts. The space between was packed with lime. All four retorts discharged into one hopper from which the coke was removed by a conveyor of the plate-carrying type, running at an average speed of 18 feet per hour.

The next plant was to the order of the Bournemouth Gas and Water Company. Four settings, each of four retorts, were installed and started up in January 1907. About the same time the Gas Light and Coke Company, and the Liverpool United Gas Light Company decided to erect installations each of two settings of four retorts. These were 25 feet long and were machine-made in short sections, instead of being made by hand as the previous retorts had been. The section remained oval, 24 by 10 inches at the top, and 30 by 22 inches at the bottom. The combustion chamber was four feet from the top, the idea being that the cool coal at the top would condense out some of the tar. Trouble was experienced, owing to the top coal sticking; the combustion chamber was subsequently raised to as near the top of the retorts as practicable. A reciprocating coke-discharging device was provided to ensure equal discharge from each retort, and the coke was brought

out quickly through a water-seal in about 15 seconds by means of a conveyor. The bottom conveyors gave trouble on all three plants, and, in addition, trouble was experienced at Liverpool with leaky retorts. That plant was eventually shut down, as vertical retort gas could not attain the high illuminating standard which was at the time required. It was before the advent of the Gas Regulation Act 1920. The experience gained showed that radical alterations to the bottom extracting gear were necessary. There was evolved, as the result, the star-shaped extractor, which has become characteristic of Woodall-Duckham retorts. This extractor is formed of a series of cast-iron stars mounted on a square shaft. Each star has a slight lead on its neighbor so that in effect a helix is formed. At the same time, in order to prevent infiltration of air at the bottom of the retort, the water-sealed door was developed.

From these early experiences the system of continuous carbonization has gradually been built up, until now it has reached a high level of both mechanical perfection and thermal efficiency.

In the design of the Tsurvmi plant at Tokyo the retort is about 25 feet long, and is of rectangular tapered shape, to allow continuous regular movement of the charge of coal through the retort. The speed of descent is regulated, so that the coal entering at the top is gradually carbonized and converted into coke by the time it arrives at the bottom. The coal, as it passes through the retort, is heated and the various by-products are evolved as the coal reaches the necessary temperatures. The retort is heated by the combustion of producer gas in a series of combustion chambers which are built at each side of the retort, the direction of combustion being downwards. Most of the heat in the coke is utilized for the production of water gas by the admission of saturated steam at the bottom.

The development work in connection with vertical retorts could be discussed under the following five heads :—(1) Reliability; (2) Output in relation to ground space occupied ; (3) Value of Refractory Materials ; (4) Heat Conservation ; (5) Advantages of mixture of coal gas and water gas.

(1) *Reliability.*—Before any continuous plant could be regarded as a successful gas-making unit it is essential that the continuous vertical retort should be as reliable as the standard intermittent types of plant. This has been attained by attention to the correct taper of the retort itself ; to the development of a reliable coke-extracting device ; and to attention to the correct design of the top ironwork.

(2). *Output in relation to Ground Space Occupied.*—It was fully appreciated from early days that one of the great advantages of continuous verticals was the larger output of gas obtainable per square foot of ground space occupied. Of all forms of carbonizing plant continuous verticals give the largest output. In this direction striking developments have been made within the past few years. The following table shows the ground space taken up by three typical installations of Woodall-Duckham continuous vertical retorts.

Installation	*Year*	*Capacity tons per 24 hours*	*Ground space occupied square ft.*	*Square feet ground space per ton carbonized per 24 hours*	*Cubic feet gas (500 B.Th.U.) per square ft. ground space per 24 hours* *
A	1914	120	4,970	41.4	377
B	1925	512	13,420	26.2	595
C	1927	695	14,232	20.5	761

* Based on an average yield of 15,600 cubic feet per ton.

In an installation which is now being built the ground space occupied per ton of coal carbonized per 24 hours is slightly less than half that which was required in a year 1914 installation. In other words the output of gas per square foot of ground space has been doubled. In comparison with old hand-charged stop-ended horizontal retorts of 20 years ago the modern vertical retort installation can produce nearly eight times as much gas per square foot of ground space occupied.

(3) *Value of Refractory Materials.*—Referring to the influence of refractory materials on the design of vertical retorts, it may be stated that all retort faces and combustion chambers are now constructed of best quality silica material. This has enabled higher temperatures to be carried in the combustion chambers, with the result that the output per retort per day has been considerably increased. Broadly speaking the use of silica and the consequent carrying of higher temperatures has in itself resulted in a 50 per cent increase in the output of gas as compared with the old fireclay type of retort.

(4). *Heat Conservation.*—As to heat conservation the modern continuous vertical retort installation is highly efficient from the thermal point of view. In the old days heat conservation was aimed at by the construction of recuperative settings. In the latest type of plants the settings are of the non-recuperative type, the heat from the waste gases being used for the production of steam in waste-heat boilers. It was possible in the old recuperative type of setting to raise approximately 800 lbs. of steam in waste-heat boilers per ton of coal carbonized, while in the modern non-recuperative settings as much as 1,500 lbs. of steam per ton are produced. An ample supply of steam for operating the producers, steaming the retorts, and working the auxiliary plant is thereby provided. By the elimination of recuperators it has been possible to close up the centres of the retorts, with the result that a larger output of gas is obtained per unit of ground space. Another factor which has contributed to improved thermal efficiency with continuous carbonization has been the development of the process of steaming. In it the heat from the coke at the bottom of the retort is utilized for the production of water-gas within the retort itself. It has had the effect of increasing the thermal efficiency of the plant, and also of materially increasing the thermal yield of gas per ton of coal. Heat conservation has also been effected by attention to heat insulation. Heat insulating materials, either in the form of hollow blocks, insulating bricks, slag wool, or lagging, are now scientifically used throughout modern vertical retort plants. As far as may be practicable the heat generated during carbonization is by that means conserved.

(5) *Advantages of Mixture of Coal Gas and Water Gas.*—Although continuous vertical retorts have developed mainly as a carbonizing system they possess other striking advantages. In most parts of the world there is now a tendency to supply a mixture of coal gas and water gas. There are two ways of making such a mixture. Either by the production of water gas from coke in separate water gas generators, and mixing it with straight coal gas; or alternatively, by producing mixed gas in a one-stage process. It is for the latter process that the continuous vertical retort is peculiarly suitable. By the admission of steam at the base of the retort, water gas is generated, which, passing up the retort, mixes with the coal gas evolved from the coal in the upper part of the retort. A regular supply of mixed gas is thereby obtained. Hence the coal, which in straight carbonization would be capable of producing say 12,000 cubic feet of gas per ton of coal, having a calorific value of 560 B.Th.U's. per cubic foot, could produce over 20,000 cubic feet per ton of 450 B.Th.U. gas. Efficient steaming has been made possible by the adoption of silica construction ; by increasing the heats in the lower portion of the retort ; and by studying the problems of steam distribution.

New Works for the Tokyo Gas Company at Tsurumi

When I visited the new works at Tsurumi for the Tokyo Gas Company the Woodall-Duckham plant was being delivered. It consists of two benches, each containing twenty-two 103-inch retorts, and capable of carbonizing 440 tons of coal per 24 hours. Each bench will be heated by means of five producers built in an independent battery at floor level, away from the retort bench, but connected to it by a common producer gas main. The waste gases from each battery of retorts will be collected in a main and will pass to a waste-heat boiler. A separate boiler is provided for each bench. The benches are of the non-recuperative type, and the waste gases will therefore pass to the waste heat boilers at high temperatures. Each retort will be under independent control, being provided with its own producer gas, secondary air, and waste gas flue dampers, and will thus form a complete heating unit. The retort faces, and the combustion chambers, are built of first-class silica brick for the full depth of the combustion chambers. There are means for varying the temperatures at the top, and at the bottom, of the combustion chambers ; and additional secondary air inlets, controlled by separate dampers, are provided. Both the side walls, and the top of the bench, are faced with hollow blocks packed with slag wool. Outside these blocks on the side walls for some distance down, is laid a thick coating of insulating material to reduce the loss through radiation to a minimum. From each retort a 9-inch offtake pipe passes up one end of the retort

mouthpieces into a very ample collecting-main which is common to the retorts on one side of each bench, there being four collecting-mains in all. A drop valve, of the mushroom type, is fitted on the inlet to the main with a cleaning door opposite the sloping section of the pipe.

In order to obtain satisfactory heating of the retorts a regular supply of good quality producer gas is essential. The closest attention has therefore been paid to the design of the producers. The producer gas for each bench will be made in a battery of five step-grate producers. Ample grate area will be provided, and the heats in the setting will be maintained, even in the event of inferior fuel being used. The producer gas will be led by uptake pipes into a common distributing main which will extend the whole length of the retort bench, and be built of mild steel plates. The main is to be lined with 7½ inches of insulating material. A rectangular header will lead the producer gas into each pair of retorts. On one side of every bench will be built a waste-gas main, in which the waste gases from the various retorts will be collected. This main is constructed of steel plates and is lined with 13½ inches of firebrick. The gases from each bench will be conveyed, by means of this main, to a waste-heat boiler, in which most of the heat contained in the waste gases will be converted into steam.

The waste heat boilers are of the special horizontal fire-tube type, and are capable of generating approximately 16,000 lbs. of steam per boiler per hour.

This Woodall-Duckham plant—the last word in vertical retort construction—will be watched with close interest by the gas engineers of Japan, all of whom are very alert in keeping themselves *au fait* with the latest developments relating to their work. Deputations are sent to Great Britain where through the courtesy of the respective officials of the gas undertakings Japanese gas engineers are enabled to become conversant with the most recent British gas practice. Incidentally the trade of our country benefits. I was greatly struck by the frequency with which British plant had been adopted wherever I went; but if I might venture on a word of advice to our enterprising manufacturers it would be to say "Send your representatives over. Personal contact with your desired client is of the greatest value. He will thus have shown him by those best able to do so, the advantages to be derived from the machinery or apparatus offered for sale."

Osaka

The government license for the opeTheons of the Osaka Gas Company was issued in the year 1896. rati company commenced work in the following year with a capital of Y.350,000. Now its capital stands at no less than Y.34,000,000, of which Y.29,750,-000 have been paid up. A large extension of the plant has been recently decided upon. Until several years ago the company had worked with American capital. Then Mr. T. Nomura bought all the shares belonging to the Americans, so that the company is now operating entirely on Japanese capital. At the end of 1928 there were 539 miles of mains laid. Of service pipes there were 1,589 miles; and of high-pressure pipes 48 miles. The company possesses five gas-holders with an aggregate capacity of 10 million cubic feet. There are also three other holders capable of containing 200,000 cubic feet for storing water gas. The company's producing power is 9,580,000 cubic feet of coal gas and 6,310,000 cubic feet of water gas per 24 hours.

The company supplies the city of Osaka, with the exception of only a small part of it. Villages and small towns in the vicinity are also supplied. The undertaking operates under the mutual interest of the municipality, which receives 5 per cent of the net profits every year.

Kobe

The works of the Kobe Gas Company I visited under the guidance of the deputy engineer and secretary. A Tully total gasification gas plant is here a successful feature of the installation, although it is not one of the latest designs, there being no automatic mechanical operator fitted. It is interesting to remark that the old type of Tully plants, which have been remodelled, are giving at least 30 per cent more output and 25 per cent greater efficiency than before their alteration. A total gasification plant of the type installed at Kobe is working at Lerwick supplying all the gas required by the town, no coal gas retorts being used. It is producing 35,000 cubic feet of 400 B. Th. U. gas and eight gallons of tar per ton coal at 5,000 cubic feet per hour. This represents 140 therms per ton, 70 therms from coal gas and 70 therms from the water gas.

The Kobe Gas Company was established in 1898 with a capital of only Y.98,000. Its capital to-day is Y.10,000,000. At the end of 1928 the number of houses connected up was 106,064, an increase of 6,000 over the number at the end of the previous year. During 1928 the volume of gas sold amounted to 779,839,000 cubic feet, an increase of 65,000,000 cubic feet over the preceding year. There are six gas-holders with a total capacity of 5,700,000 cubic feet. Within a period of 24 hours six million cubic feet can be sent out. The company, in addition to the manufacture of gas, is interested in several other industrial enterprises.

Kyoto

The works of the Kyoto Gas Company is the next in order of importance. Kyoto, which was included in my tour, is the old capital of Japan, and abounds in shrines and other edifices of historic interest.

It was in 1908 that the Kyoto Gas Company was established, with a capital of Y.2,000,000. To-day it has become four times that amount in paid-up capital. In addition to supplying gas to the city, about 24 villages in the surrounding neighborhood are served. In 1928 there were 68,037 houses connected. Of meters 70,355 had been installed by 1929, and 4,500 houses were newly connected. The number of meters in use was increased by 5,200. In 1928 the sale of gas amounted to 605,747,500 cubic feet, an increase of 70 millions over the previous year.

The maximum coal gas production was 3,840,000 cubic feet, and that of water gas 600,000 cubic feet. There are four gas-holders, the aggregate capacity of which is 3,500,000 cubic feet.

Nogoya

The Toho Gas Company, which, as already stated, is an amalgamation of twelve gas undertakings, has its headquarters at the town of Nogoya. I travelled there from Tokyo by a sleeping berth train, and was cordially received by the engineers on my arrival. The company's works are situated in an area of which the center is approximately Nogoya, a town which may be compared to our Stoke-on- rent, being famous for its production of high-class pottery ware.

From a photograph which was given me as a souvenir of my visit to the gasworks of Nogoya. The signatures upon it are of the members of the engineering staff who entertained me. Several special features attracted my attention on going over the works. The method of discharging the coal barges, which are brought up the narrow canal running at the side of the works, consists in the application of an endless band of buckets. It is lowered into the hold of the barge, and as it rotates each bucket in turn overbalances its contents on to a rubber conveyor band running at the top, which takes the coal to the store. A bench of retorts exposed to the open air looked unusual, and was not in consonance with one's ideas of heat conservation.

An excellent showroom is open in the business part of the city in a much-frequented thoroughfare. In it are exhibited all the different specimens of cooking, heating, and other gas apparatus supplied by the company. The uses of industrial gas are encouraged, there being a series of furnaces in operation for demonstration purposes. The application of gas as a heating agent in pottery work was appropriately conspicuous.

The Japanese people have a *national* way of cooking their food; the gas company have accordingly designed an ingeniously contrived, yet simple, appliance for domestic cooking. It is becoming very popular and selling well. All the British designs of water-heaters and cookers were on view.

It may be mentioned that the principal other towns served by the Toho Gas Company in addition to Nogoya are Kiushu, Fukuoka, Saseho, Nagasaki, and Kumamoto.

Yokohama

The gas undertaking at Yokohama belongs to the municipality, and was established in the year 1879. The total length of its distributing pipes is 192,308 metres (119.1 miles). Gas-holder capacity of 48,136 cubic metres is provided. The total annual

make of gas is 11,257,878 cubic metres. Houses to the number of 26,033 are connected up. For the purposes of heating, 96.3 per cent of the total make is employed. For lighting 3.7 per cent. only.

Yokohama is the port for Tokyo, being only a few miles distant, although many on their way home to England do, as I did, take steamer from the port of Kobe, and thus get a day or so extra time for sightseeing before leaving Japan.

In common with my fellow members of the World Engineering Congress I was immensely impressed by the splendid spirit displayed by the people of Japan after the overwhelming catastrophe which overtook the city of Tokyo on Saturday, September 1, 1923. The earthquake was of such magnitude as to give it an unparallelled position in the records of similar events contained in the history of the world. In the wake of disaster an enormous fire was inevitable, for the water pipes in connection with the fire service were broken all over the city. In the space of two days about one half of Tokyo, and practically the whole of Yokohama were reduced to ashes. It is computed that the number of people who perished amounted to no less than 91,344. In Tokyo 558,049 houses were totally destroyed.

The reconstruction work which we saw has just been completed the Emperor having been present at the ceremony which marked the historic occasion. The stupendous job by which the nation was confronted may be appreciated from the statement that the devastated area covered no less than 8,783 acres. The fund allocated for the work amounted to 700 million yen. For the year 1927 the reconstruction budget showed that Y.596,483,000 had been provided by the state; that the state had voted a subsidy of Y.20,000,000 for buildings in the fire zone; and that expenses borne by local government authorities amounted to Y.376,683,379.

There is no doubt that the gas industry of Japan has been established on a sound basis, and that it is making rapid development. In the early years of its progress it has been assisted materially by both American and British gas engineers. The engineer of Japan is always ready to acknowledge the help derived from his friends from abroad. One departed from the Land of the Rising Sun with feelings of admiration and respect for a nation that has shown such untiring industry in all its phases of scientific endeavor. In the comparatively brief period of about fifty years during the benificent *reign of the venerated Emperor Meiji*, Japan has gained such a position as to be accepted as one of the five great powers of the world.

The following, translated from an article which appeared in the *Journal des Usines a Gaz* of March 20, 1930, significantly shows the position of the gas industry of Japan to-day. The plant at both Tokyo and Osaka is being continually developed and extended. In 1928 all the undertakings supplied gas to 1,079,000 houses at the rate of 1,585,000 M3 (37,380,915 cubic feet) per day. The total capacity of production was 2,130,000 M3 (74,267,444 cubic feet) per day.

TABLE I.

	Number	*Nominal Capital in yen*	*Capital employed.*
Gas Companies (exclusively)	62	207,127,000	137,021,000
Companies producing gas with other commodities	10	117,540,000	135,128,000
Municipal Undertakings	5	—	—
Companies in course of formation ..	12	5,680,000	—
Totals	89	390,347,000	272,219,000

TABLE 2. *Year 1928.*

Principal Companies	*Capital yen*	*Dividends per cent*	*No. of Consumers*	*Daily sale*	
				Cub. metres	*cubic feet*
Tokyo	100,000,000	9	376,529	788,769	27,855
Osaka	34,000,000	12	210,128	343,082	8,581
Kyoto	8,000,000	14	63,544	78,026	2,755
Kobe	10,000,000	12	95,901	104,603	3,694
Nagoya	24,000,000	12	70,033	90,763	3,224
Yokohama ..	—	—	26,033	26,469	934

If one remembers that the population of these great towns is in the case of Tokyo about 2,300,000, Osaka 2,500,000, Kyoto 750,000, Kobe 750,000, Nagoya 950,000, one can see that the consumption of gas per head is much below what the undertakings in Europe are accustomed to. But it is already known that Tokyo is developing its installations at a cost of 50 million yen to supply gas to 100,000 more consumers in 1928, and 140,000 more at the end of 1929, because of the increasing demand. The figures given are those of 1927. In 1928 Tokyo registered 112,840 new consumers.

It is the same at Osaka, where since 1927 two new works have been constructed at Iwasaki and Shamitau capable of producing seven million cubic feet per diem. These installations have cost six million yen.

Last year numerous Japanese missions came to Europe to study different systems of production and exploitation. They have adopted European meters and distribution methods.

Subways in Japanese Cities

THE cities of Japan are now finding their surface tramway systems inadequate to handle the increasing flow of urban transit and are turning to the large-scale construction of subways.

Streets that even 20 years ago saw little traffic but the scurrying man-drawn vehicles or carts variously hauled by oxen, horses or humans, now are torn and riven as armies of laborers and great machines bore new highways to carry the millions from suburban homes to office, shop and factory.

Tokyo, which began her first underground railway five years ago, has just adopted plans for a second subway system. Osaka is in the midst of a subway and elevated railway program that will cost about Yen 163,000,000 and give the commercial center of the Empire about 33 miles of rapid transit lines. The third and fourth cities, Nagoya and Kobe, have drafted subway plans and applied to the Central Government for approval.

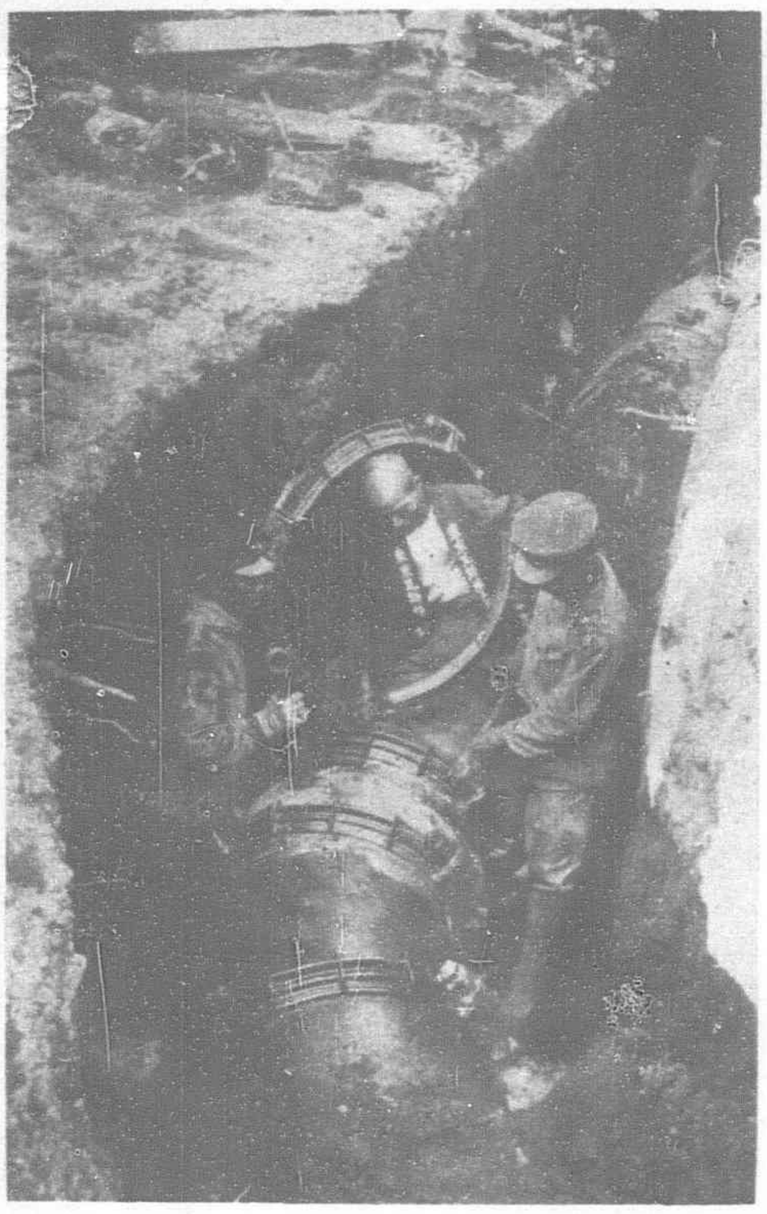
A private corporation is building Tokyo's first subway, the Tokyo Underground Railway Company, with an initial capital of Yen 20,000,000 and the city's charter to bore 10.3 miles of underground lines, traversing Tokyo's longest axis, northeast to southwest. Two and a half miles of this system are in operation, and the business success of this company is largely responsible for the rapid spread of the subway idea in Japan.

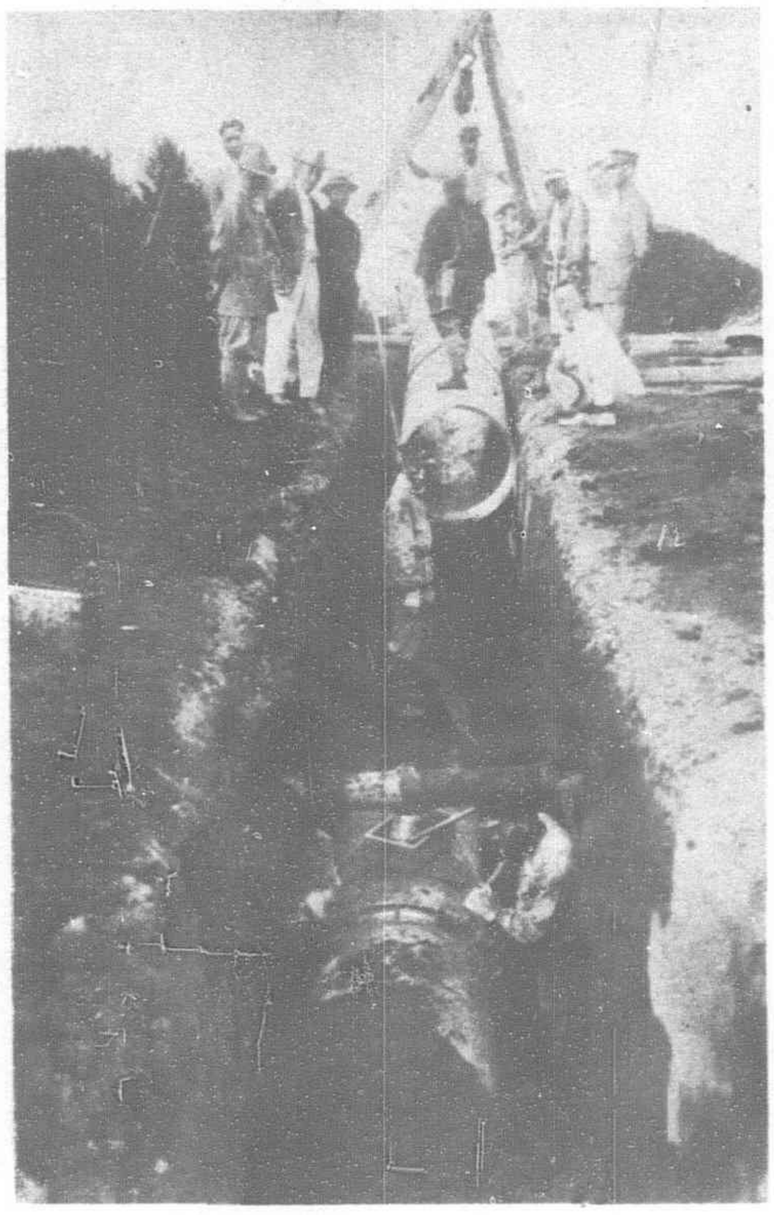
Tokyo has now announced plans for a second system, city owned, to link the business center with the western residential districts of Shibuya and Ikebukuro, 12 miles of tubes costing about Yen 60,000,000. Bonds for these lines will be floated in the autumn and work started immediately thereafter. This project is launched at this time partly to alleviate the capital's unemployment problem, as it is expected to provide jobs for several thousand laborers for the next five years.

Osaka's program is still more ambitious, calling for 18 miles of subways and 15 miles of elevated lines to be completed by 1935. Boring on the first subway section, a nine-mile line running from the main railway station on the north southward through the heart of the city, was begun last winter and should be completed next year. The builders have considerable engineering problems to overcome, including the task of tunneling under two good-sized rivers.

Promoters in Nagoya, fastest-growing of all the cities of Nippon, with close to 1,000,000 population, have applied for a charter for a Yen 15,000,000 Nagoya Subway Company. Kobe has a project of similar dimensions. Even Kyoto, the ancient capital, formerly one of the most somnolent cities of the Orient, is experiencing the stirrings and growing pains that call for underground rapid transit, although its plans are still in the nebulous stage.

Modernization, industrialization, rapid growth of suburbs, demand for speed, all have made the surface transit systems of Osaka and Tokyo inadequate. Bus lines have been started to supplement the tramway system, and during the last three years thousands of cheap taxicabs have come to the cities, but the hundreds of thousands who want to be carried to work daily are growing faster than the means of travel. Tokyo and Osaka are among the ten largest cities of the world and growing rapidly. Osaka has a population of over 2,400,000, and Tokyo, while numbering only 2,300,000 inhabitants within the 15 wards of the old city, is the center of a metropolitan area with 5,000,000 residents, of whom nearly a million flow each day into the city's center and out again.—*Associated Press.*





Laying 30-in. Mains of the Tokyo Gas Company with "Victualic" Flexible Pipe Joints

Flexible Pipe Joints for Tokyo Gas Works

Some time ago some reference was made in these columns to the extensive installation of "Victualic" flexible pipe joints ordered by the Tokyo Gas Company in Japan. This forms part of the complete re-organization carried out after the earthquake and consists of 16,890 joints for 40 miles of high pressure pipe line, varying in size from 6-in to 30-in diameter, which followed upon a previous delivery in 1928 of 2,000 joints, 24-in. to 30-in. diameter.

We are now able to reproduce herewith a number of photographs relating to this contract in Tokyo, showing the laying of some of the 30-in mains. It may be stated also that this particular pipe line was installed under considerable difficulties as the underground water was often as high as above the centre line of the pipes, and the opinion of the Japanese contractors is that it would have been utterly impossible to have laid the pipe line in the specified time if the joints had not been on the "Victualic" principle. It will be remembered that the actual joint is made in a minute or two merely by bolting on an outer covering, as indicated in the photograph. Also more than 3,000 of these 30-in. joints were included in the contract, but, as indicated, the sizes vary, comprising 6-in., 8-in., 12-in., 16-in., 20-in. 24-in. and 30-in. fitted on the 40 miles of pipes.

The Victualic Company Ltd. had an interesting display at the recent British Industries Fair, Birmingham, which included for example a special "flexing" model showing a jointed pipe being driven at high speed by a motor while absolutely tight at 30 lbs. per square inch main pressure, while on similar lines was a 2-in. flexing connection from a 2-in. bend, also driven by an electric motor under the same pressure. Further, there was a demonstration arrangement demonstrating the tightness of the joints under 500 lbs. per square inch hydraulic pressure, and many different fittings in the shape of special bends, tees, elbows, flanged adaptors, and adjustable bends and blanks, together with special varieties such as the thief-proof joint Type "H.T." flanged joint, and the hydraulic joint of steel alloy and forged steel.

It may be remembered the "Victualic" flexible joint was the invention of the late Lieutenant Tribe, with final collaboration of Dr. Hele-Shaw, Past President of the Institution of Mechanical Engineers, and the field of application includes compressed air, towns gas, natural gas, crude oil, petrol, benzine, water, sea water, and sewage, to mention a few examples only.

Goodell-Pratt Tools

Tool catalogs are not as a rule inspiring publications, but when a manufacturer tears his old catalog completely apart, and painstakingly revises it so as to put all the 1,500 or more tools in convenient classifications and logical groupings, with fine, clear cuts and attractive color pages, then the issuing of a catalog of this kind becomes an outstanding event.

This is exactly what has been done in the case of the new No. 17 catalog of the well-known house of Goodell-Pratt Company, of Greenfield, Mass., U.S.A., for forty-two years manufacturers of tools for men who know and appreciate good tools.

The convenience of the buyer was one of the prime considerations kept in view when printing this new 146 page catalog. This is easily apparent from the careful arrangement of the many classifications of tools manufactured, and the logical sequence in which they are placed.

Many new tools appear in this catalog. Among them are several fine new Screw Drivers, a new Automatic Drill, new Micrometers, a new Hack Saw Frame, a new Woodworking Lathe, and new Cold Chisels and Punches.

These additions round out the Goodell-Pratt lines with carefully selected new tools which appear to have interesting volume possibilities for every tool merchant, who knows these tools are attractively finished and easy to sell.

A new Heavy Duty Motor Driver Workshop, with many new features, is one of the exceptional items in the special colored section devoted to Electric Drills, Tools, and Accessories.

Important price revisions are effective with this issue. We recommend that every tool buyer secure a copy of this new catalog which may be had by directing a request to the Goodell-Pratt Company, Greenfield, Mass, U.S.A. or to their Far Eastern Representatives, Muller & Phipps (China) Ltd.

Kobe Harbor Works from the View of Engineering

K. TAKANISHI, DR. ENG., Chief of the Kobe Civil Engineering Bureau of the Imperial Home Affairs Department, Kobe, Japan

Outline of the Improvement Works of Kobe Harbor

THE port of Kobe is situated to the west of Osaka Bay, in Lat. 34° 41′ N. and Long. 135° 11′ E., and embraces the two bays of Kobe and Hyogo. In 1906, the improvement works were taken in hand under the supervision of the Finance Department. The work was extended in scope the following year, and plans were laid down for the construction of four piers for berthing on the sea front at Onohama, together with the building of sheds and equipment. The completed part of the work has been utilized by the Customs since October, 1913. We call this " The first extension scheme of improvement of the port of Kobe " in this paper. With the completion of the whole work, which is expected not to take long, there will be introduced a marked improvement in the arrangements of the port for trading purposes. The construction of breakwaters for protecting the anchorage had not been left unattended to, until 1910, and recognizing the urgent necessity of protecting the piers, the authorities commenced the construction of a part of the east breakwater. Although the arrangements of the harbor have continually improved, the hostilities in Europe, which had the effect of increasing the domestic and foreign trades of the port to considerable extent, have made also further claims upon the improvement and extension of the harbor. The city of Kobe was wide awake to the urgency of expediting these equipments, and volunteered to bear part of the expenditure of the undertaking. Thereupon, the government transferred the control of the work for the construction of the above-mentioned breakwater to the Home Department in April, 1919, and decided to start the extension of the equipment of the port for domestic and foreign trade at the estimated cost of Y. 27,100,000, the work to be spread over ten years from 1919, and later on, the work duration was prolonged to 15 years from some changed and addition of scheme, and at the same time it was necessary to increase the estimated cost of Y.5,778,282. The scheme comprises many extensions such as an extension of the equipment for domestic trade at Hyogo, an extension of the equipment for foreign trade on the seafront of Hamabe-dori, an extension of the equipment for both purposes at Kaigan-dori, the reclamation of the seashore of Hyogo and Kobe, the establishment of landing places and mooring for lighters, and an extension of breakwater for the purpose of ensuring a large protected anchorage. We call the latter " the second extension work in improvement of the port of Kobe " in this paper. Among both schemes, the quay equipments are as follows respectively.

(1) THE FIRST EXTENSION WORK.

Equipment for	*Location*	*Depth below L. W. L.*	*Length*	*Accommodation*
Foreign trade	Onohama	9.0 m.	2093.5 m.	
,,	,,	10.0 m.	329.5 m.	
,,	,,	11.0 m.	473.0 m.	
		Total ..	2896.0 m.	

(2) THE SECOND EXTENSION WORK

Equipment for	*Location*	*Depth below L. W. L.*	*Length*	*Accommodation*
Foreign trade	Hamabe-dori	12.0 m.	418.0 m.	15 vessels of large and small size.
,,	,,	10.0 m.	2183.0 m.	22 vessels of large and small size.
Home trade	Hyogo	9.0 m.	691.0 m.	
,,	,,	8.5 m.	309.0 m.	
,,	,,	7.2 m.	1218.0 m.	
,,	Kaigan-dori	9.0 m.	580.0 m.	
,,	,,	5.5 m.	370.0 m.	
		Total ..	5769.0 m.	

The traffic at the port of Kobe for both home and foreign trade is nearly 11 million tons, of which nearly 64% are considered to be handled by quay.

Therefore it is necessary to extend the quay arrangement and equipment in order to handle at least this amount of cargo, and consequently the extension of the breakwater which keeps quiet the inner harbor is a natural requirement.

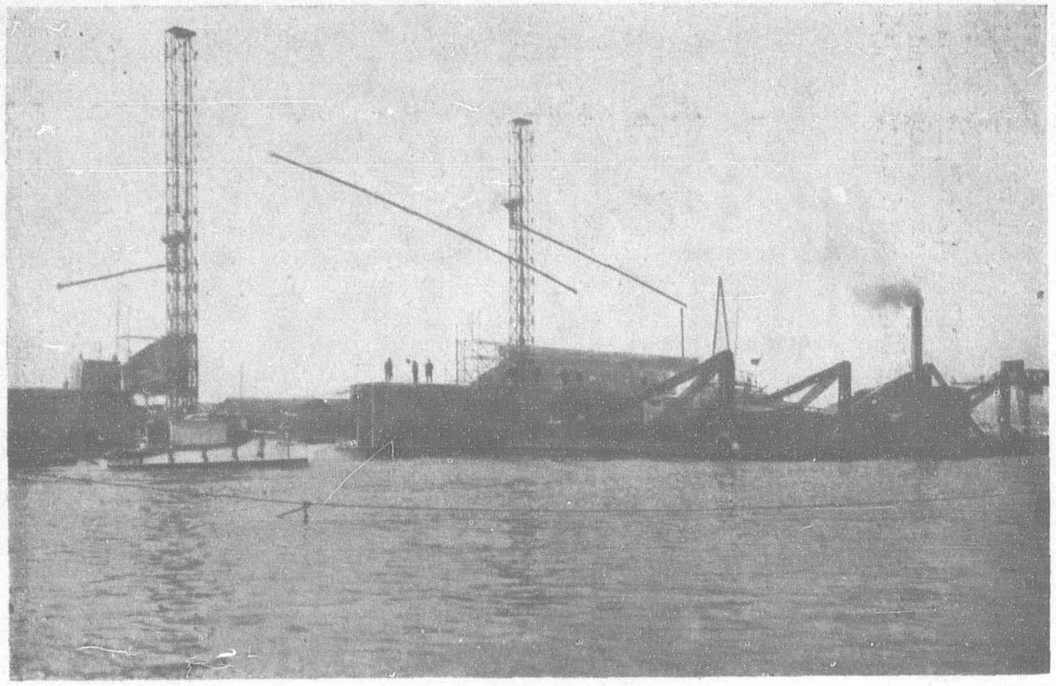
Nature of Sea Bed

The sea bed of the port of Kobe is generally covered with very fine clay and at the level of nearly 4.5m. below the surface of the sea bed near land, it contains a little sand ; along the constructed part of the quay, at the extreme position offshore, from 8m. to 11m. under sea bed, we find a small amount of sand, even that layer it is very thin and keeps only 1m. thickness. Under this layer, a clay layer is found again which is nearly 6m. thick, and unless this second layer is to be penetrated we can never reach the bed soil having reliable bearing power.

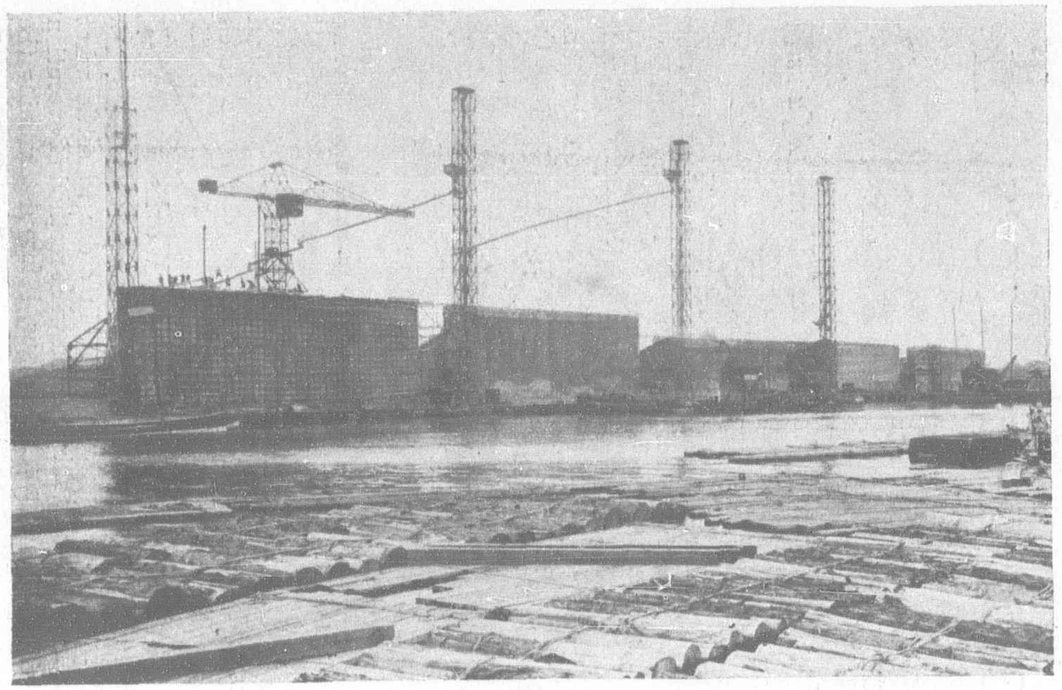
Quay Walls Construction Works

Referring to the above condition of the port of Kobe, the most careful investigations were made, in order to settle what kind of execution was really suitable and what method of execution was the best and most economical for us, before determining the cross section of the wall. Then we have carried on comparative studies about (1) walls composed of circular cylinder in ferro-concrete pier ; (2) walls by sinking concrete wells ; (3) walls composed of large ferro-concrete caissons ; (4) walls in concrete sheet pilings on front and back side and filling concrete between them. But each of these four kinds was experienced with merits and demerits on the execution of the plan, and therefore we could not find out which was absolutely the best ; but after all, for the port of Kobe which has a foundation composed of soft mud and is subjected to the frequent visitation of heavy wind and waves, the quay walls constructed in ferro-concrete caissons was acknowledged to be of the safest execution and the strongest when finished, and moreover to be of the most economical construction cost ; so we decided finally to adopt this process ; besides, this decision was made more powerful by the fact that the ferro-concrete caisson had been used already on the first extension work of this port for the construction of quay wall, and we possessed one depositing dock whose lifting power is 2,500 tons, for the special purposes of transporting and floating of caisson ; thus by adopting this process we were able to save a large expense in the equipmental cost.

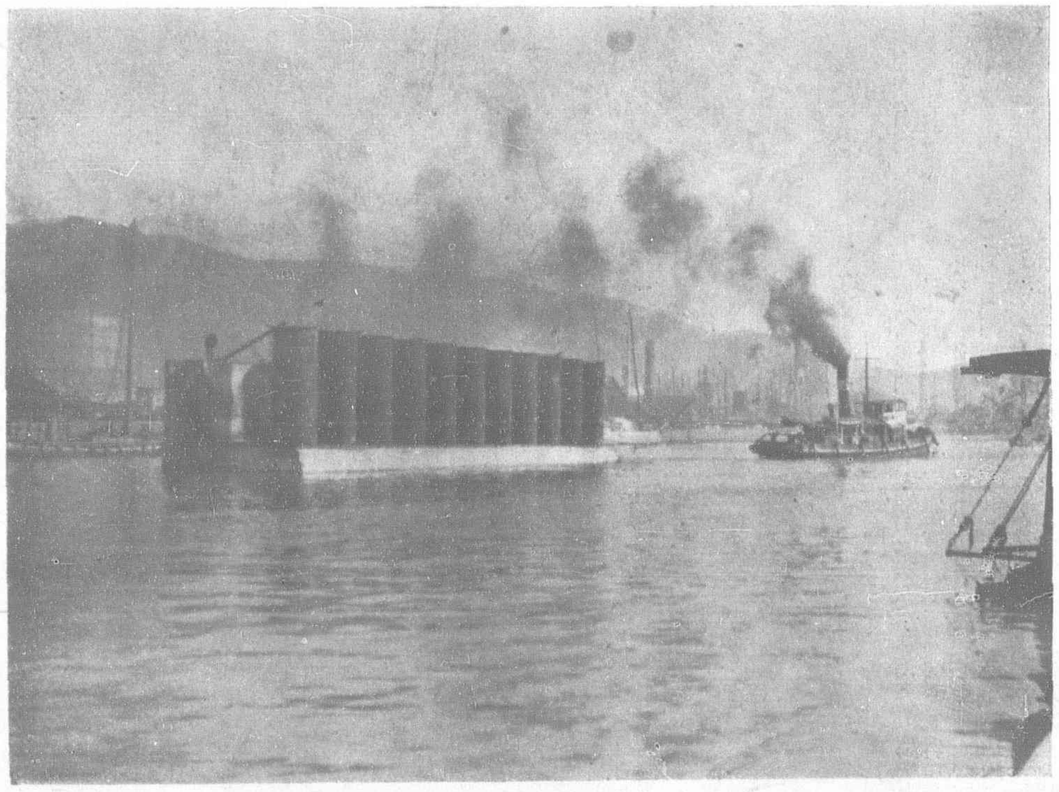
As the general opinion upon the quay wall construction, it is naturally true that the stability of the wall composed by one large mass is greater than that of small blocks ; in case of such caisson system in large mass, the caisson can be made with much care on land and deposited in water after perfect drying of the concrete ; therefore compared with the system of executing under water from the first, there are great differences between the former and the latter in difficulty of execution and in results of works. Even in the construction of the wall which is built up by concrete solid blocks or hollow blocks, etc., we generally need some powerful cranes for transporting and depositing, and if the size of the block increases, a greater crane is needed. As even a block, weighing twenty tons, is yet 1.5 m. × 2.0 m. × 3.0 m. in size. we require a large number of blocks in a wall construction, and this entails so many vertial and horizontal joints between the blocks, which form weak points in the wall and diminish its stability. In case we adopt the hollow block system as at the port of Halifax, Canada, we can surely neglect the vertical joint and will also need less transporting equipment, but we cannot remove the horizontal joints and also we have the inconvenience that the inside concrete filling work has to be executed under water.



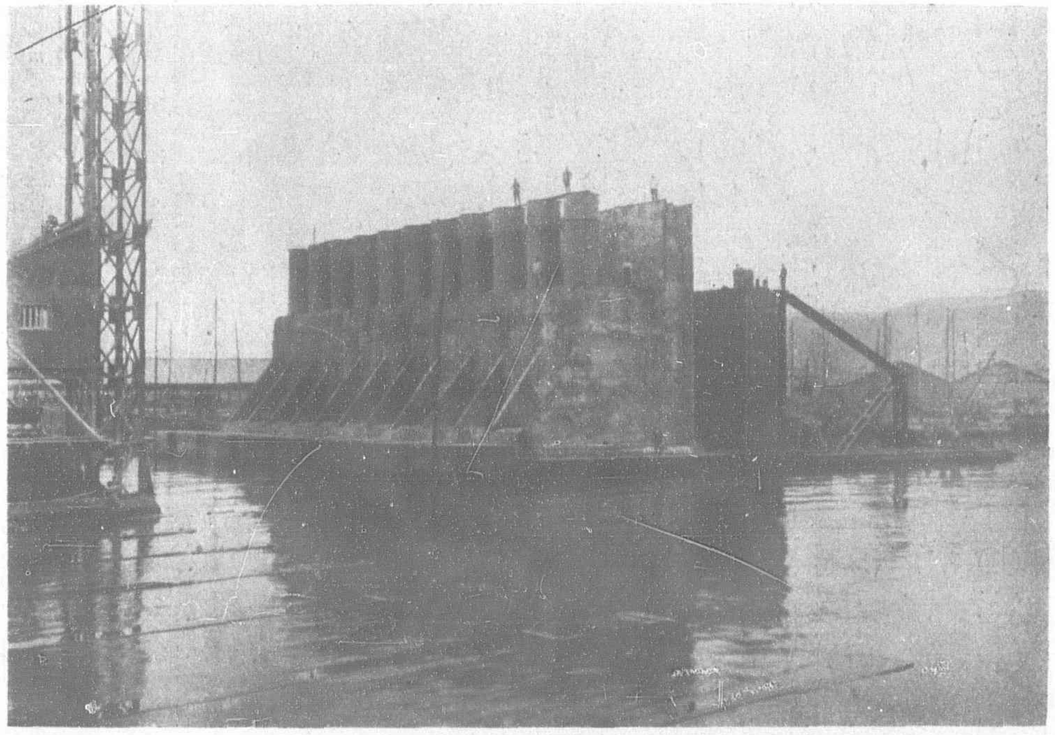
Launching the Caisson



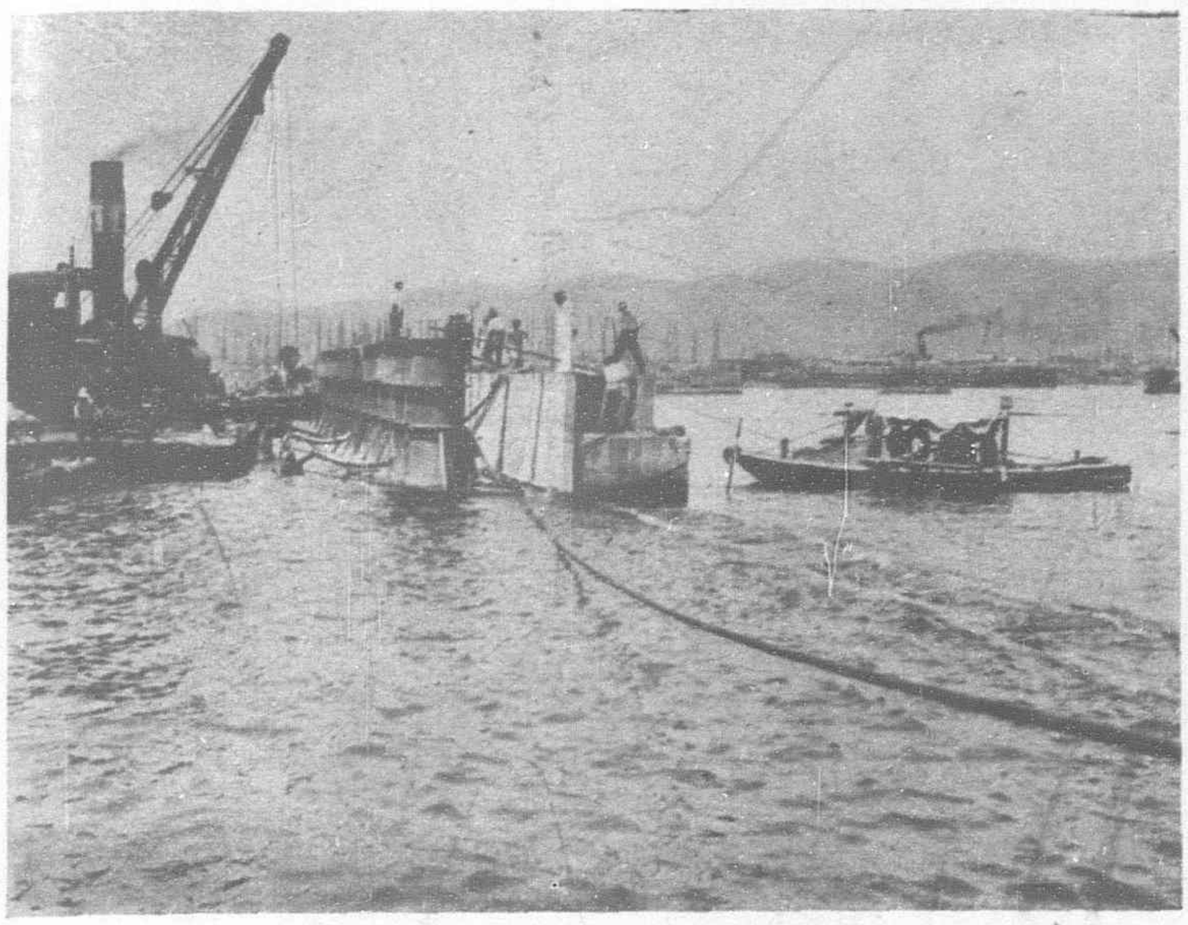
General View of the Caisson Yard



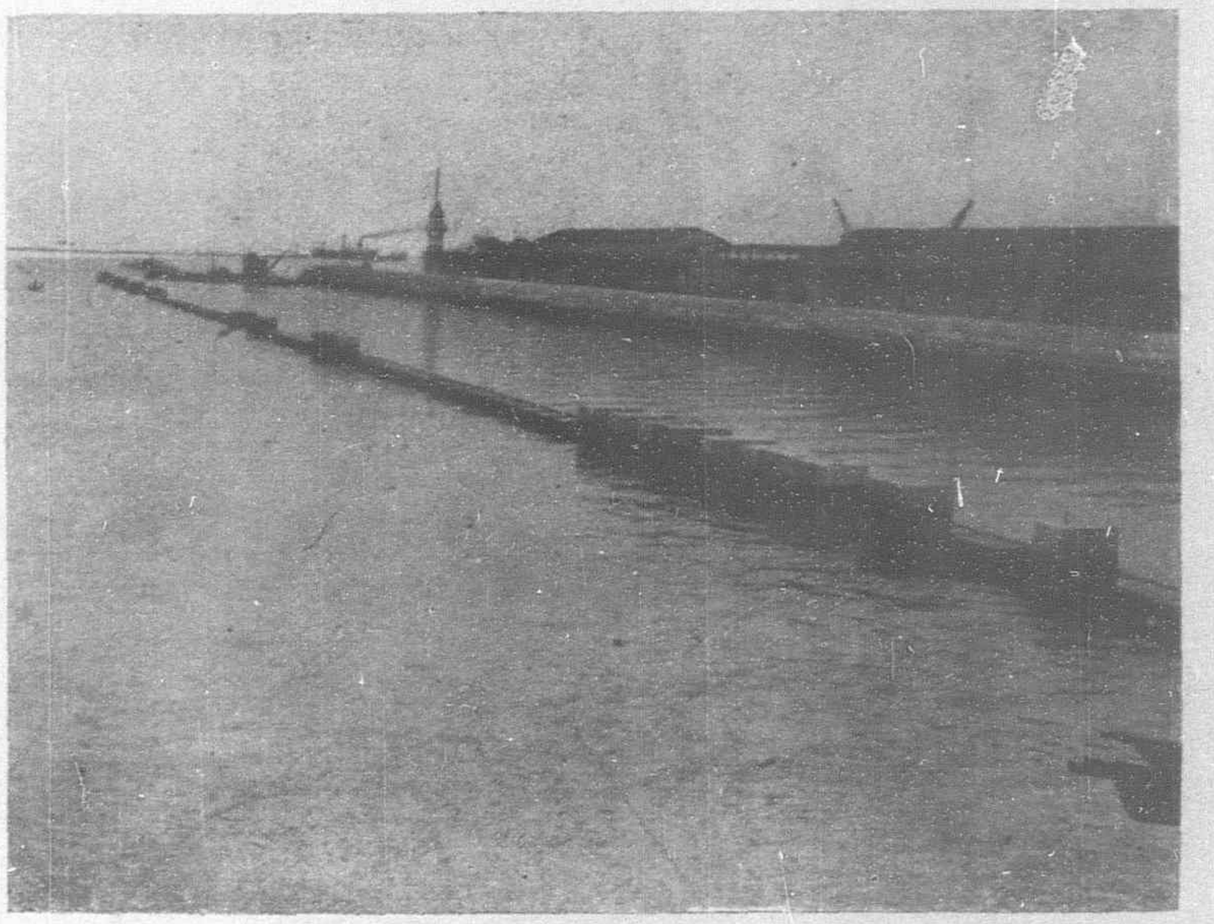
Towing the Floating Caisson



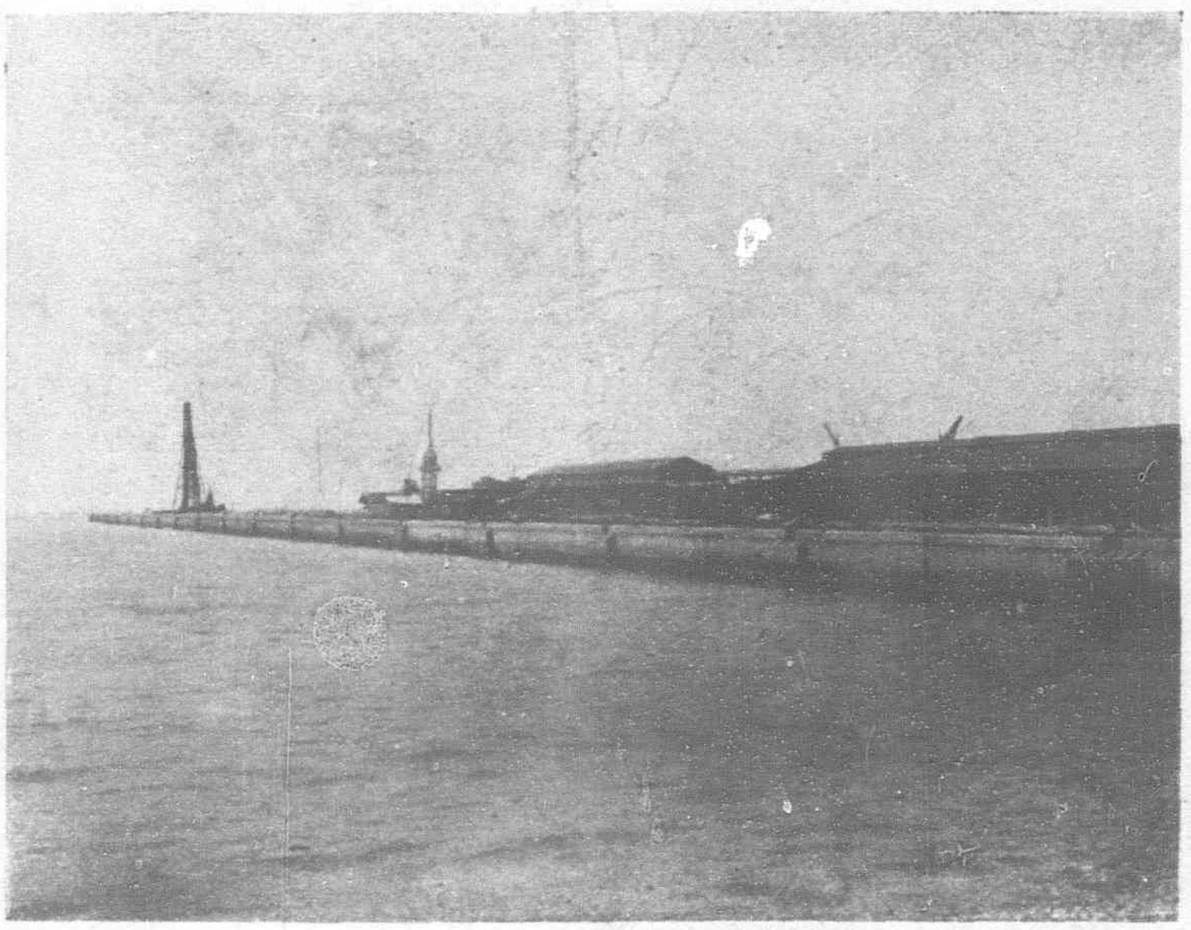
Caisson on the Floating Dock



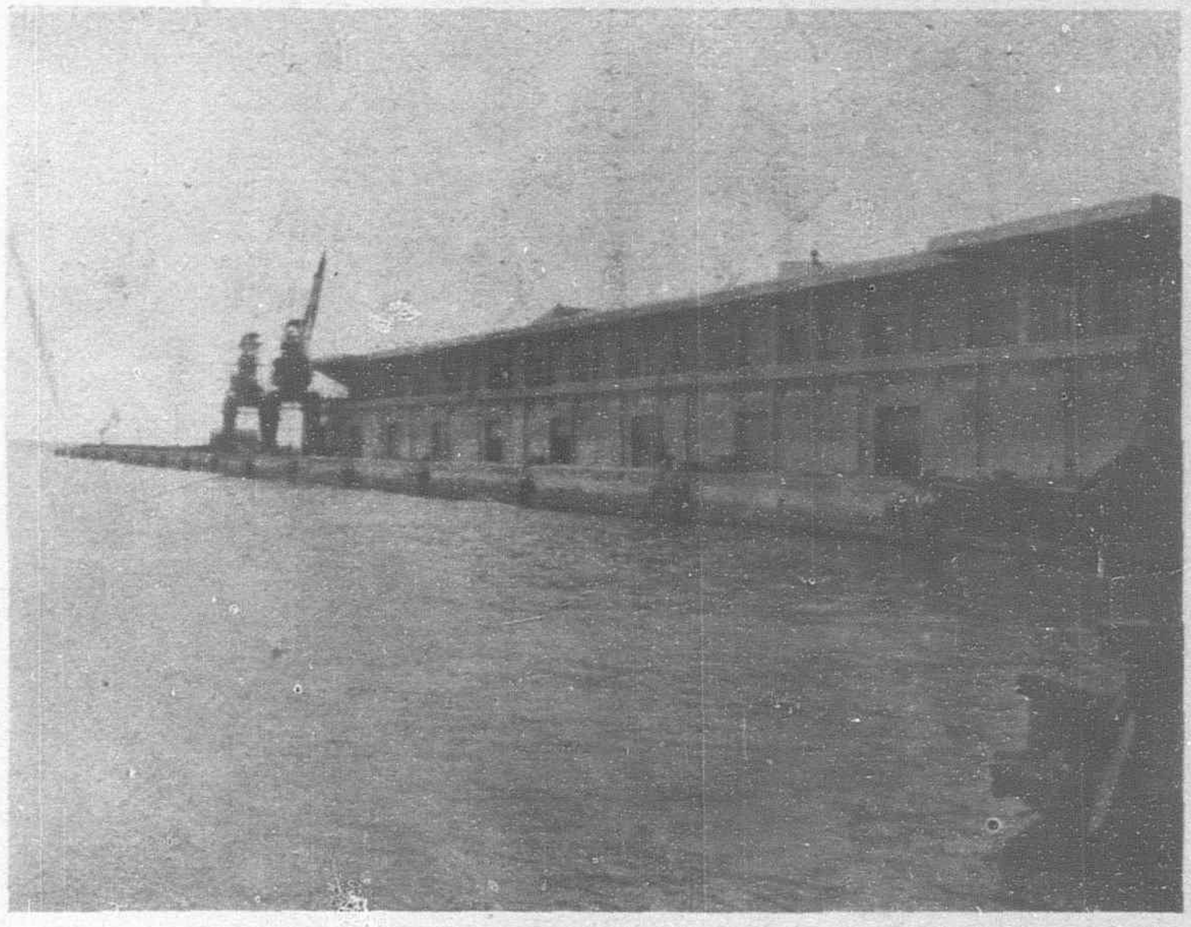
Depositing the Caisson on Site



The Pier, Formed with the Caisson



View of Finished Quay Wall



Finished Shed on First Pier

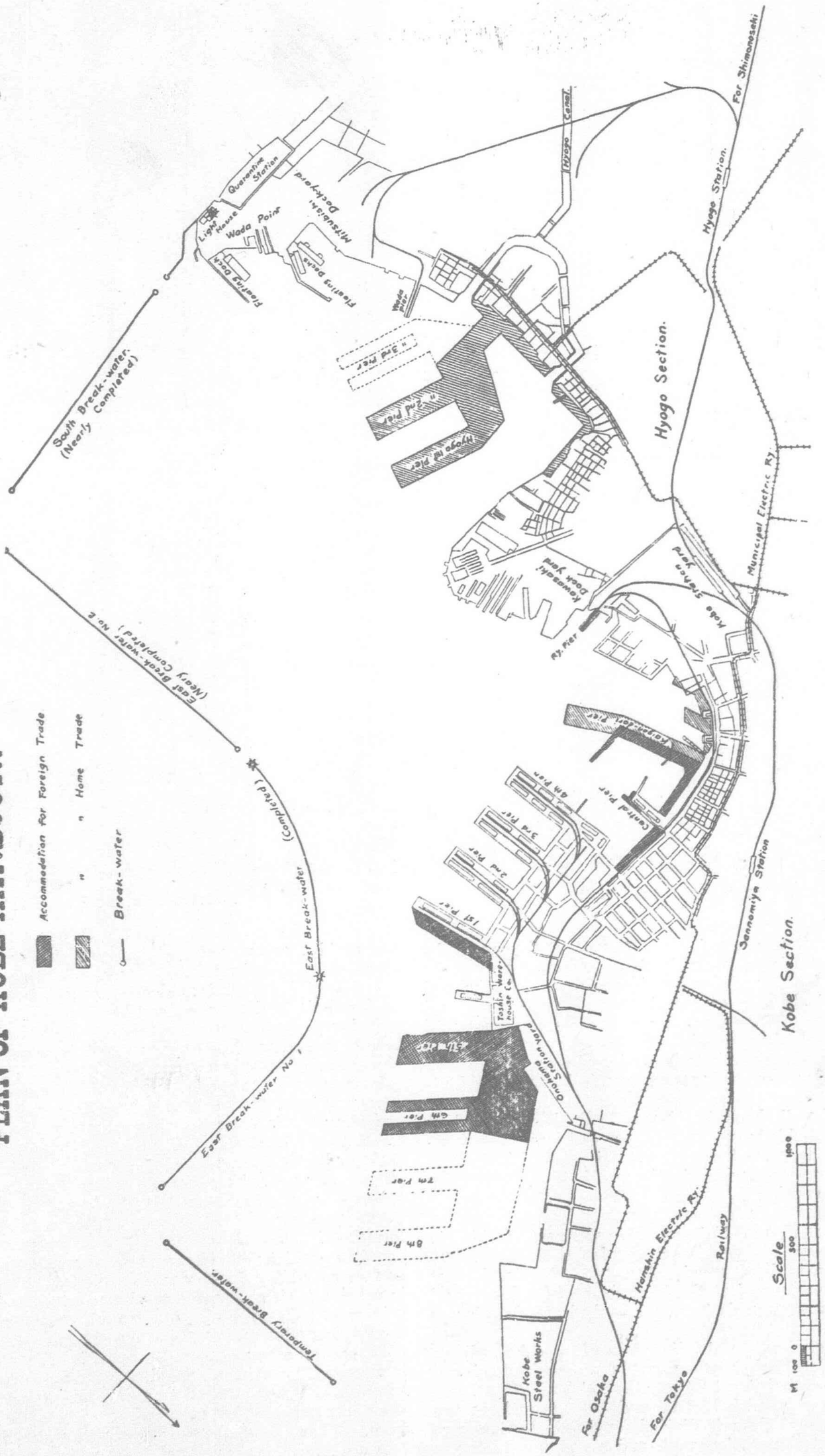
Judging from these points, it seems to us that the process by ferro-concrete caisson is generally the most perfect at present for the construction of quay wall from engineering point of view, and even though relatively large expense is spent for its making and transporting equipments, the expense per unit length of quay wall will decrease with the increase of the length of quay. Therefore in case of big harbor construction where a long length of quay wall is to be constructed we can attain very economical results by adopting this system.

From above described relations it was finally decided to adopt a caisson type wall and now we come to the question what improvement should be made to the ferro-concrete caisson used in the first scheme of this port or anywhere in the world, to make it more rational and economical.

Ferro-concrete Caisson Adopted in the First Scheme of Port Extension of Kobe.—This extension work was decided in 1906. By this scheme, quay walls of total length 2,895 m., surrounding four piers, in depth varying from 9 to 11 m. under low water level, were constructed at the front shore of Onohama, and provided with other accommodations, such as sheds, roads, railways etc.

In that scheme, of course, the dimension of the caisson differs with the quay wall depth, but generally only two kinds of caissons were used, their length being 38.5 m., the height 10.75 m. and 11.70 m., the bottom breadth 10.3 m. and 11.0 m., and the top width 7.0 m. Each of them is divided longitudinally into two chambers by a central partition wall, and these two chambers are divided transversely by nine partition walls into ten small chambers, each caisson having twenty chambers in total.

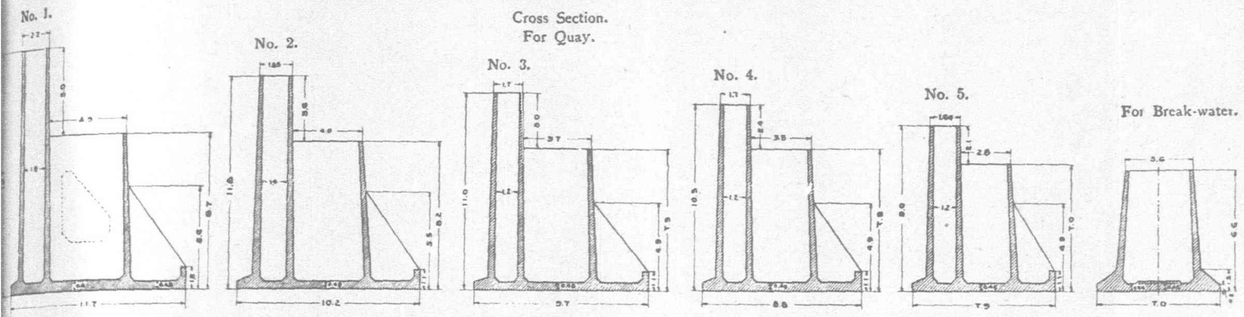
After this caisson is made on the tooth-formed piers and dried up for about 30 days, it is floated by a depositing dock on sea and pulled away by a powerful tug boat to the place where the caisson is to be sunk down ; then the sea water is poured in front and back chambers by pulsometer pumps and several sets of siphons, the caisson being kept upright. Before this the bad soil on the site of quay wall is removed, by a Priestman dredger, to the suitable depth according to the nature of the bed and replaced with good sand levelled up to a plane by divers, to get required formation with a little inclination, considering the amount of sinking at the completion of work. Then we drive four piles as guides of sinking caisson, two of them along its front side and the other two along the back side, a few meters of the upper part remaining above the bed formation. But it is not possible to fit the piles with accuracy in the right position ; therefore we generally make an alignment on the surface by adding another wooden piece in proper size joined by iron bolts, taking measures on water surface and from the top of caisson already finished. Under such arrangements, we anchor the floating caisson by ropes at every corner to the corresponding guide piles and start pumping sea water in every chamber of caisson. In this way, the caisson sinks down gradually corresponding to the quantity of water pumped in and finally it reaches the sea bed, the upper part of caisson remaining nearly 0.6 m. above low water level. When all chambers are filled with water, the caisson weight becomes nearly one thousand tons, which is not easily affected


PLAN OF KOBE HARBOUR.
Accommodation for Foreign Trade
" " Home Trade
Break-water
Quarantine Station
Light House
Wada Point
Mitsubishi Dockyard
Floating Dock
Floating Derrick
Wada Pier
Hyogo Canal
For Shimonoseki
Hyogo Station.
Hyogo Section.
South Break-water (Nearly Completed)
3rd Pier
Hyogo 1st Pier
Kawasaki Dock Yard
Ry. Pier
Municipal Electric Ry.
Hoke Steam Yard
East Break-water (Nearly Completed)
Kawasaki Pier
Central Pier
4th Pier
3rd Pier
2nd Pier
1st Pier
Toshin Warehouse Co.
Onoaeno Station Yard
Jennomiya Station
East Break-water No 1 (Completed)
Temporary Break-water
6th Pier
7th Pier
8th Pier
Kobe Steel Works
Hanshin Electric Ry.
For Osaka
For Tokyo
Railway
Kobe Section.
Scale
300
100 0 1000

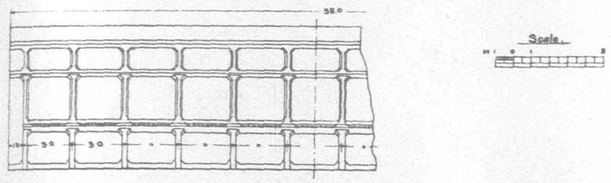
Quay Wall and Break-water Construction at Kobe Harbour.

Reinforced Concrete Caissons.

Cross Section.
For Quay.

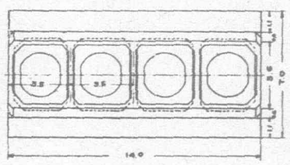


Plan of Caisson for Quay.



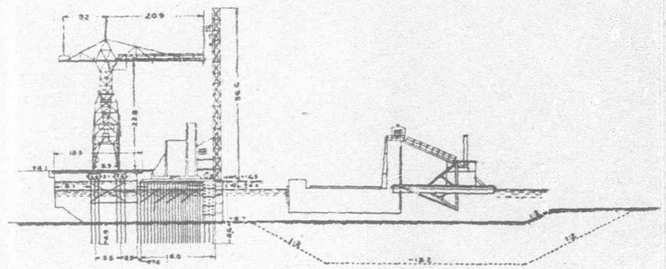
Scale.

Plan of Caisson for Break-water.



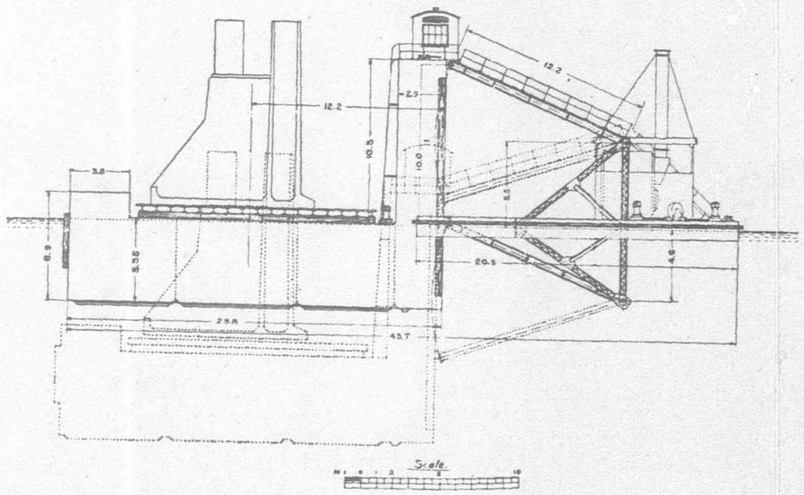
Caisson Yard.

Side View.



Depositing Dock.

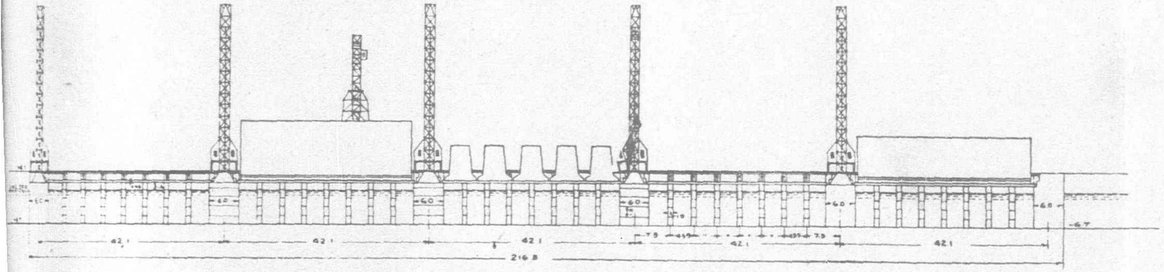
Side View.



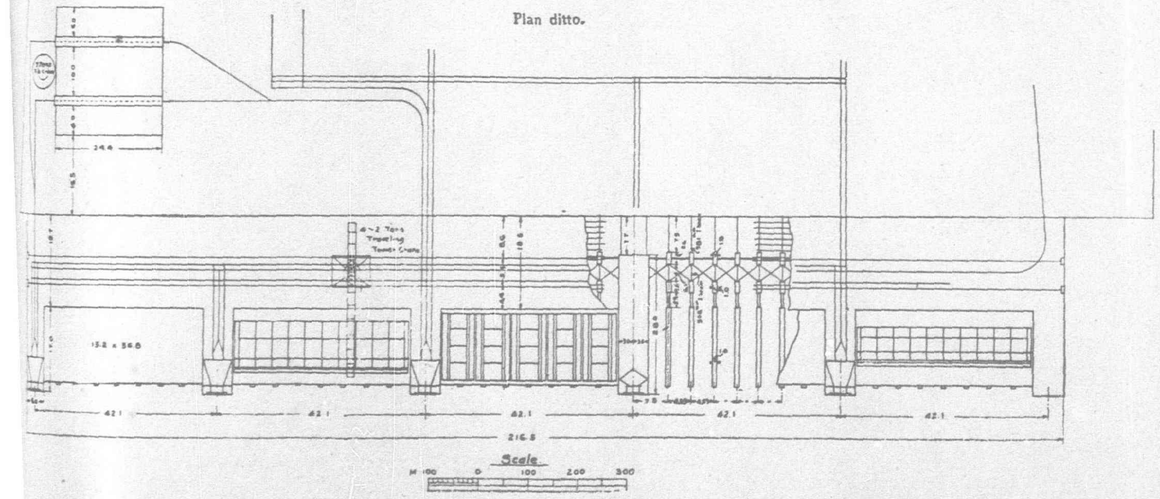
Scale.

Caisson Yard.

Elevation.



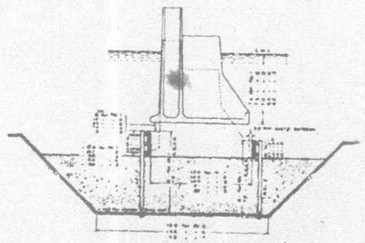
Plan ditto.



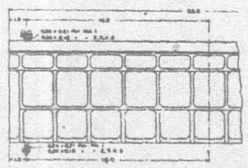
Scale.

Sinking of Caisson.

Side View.

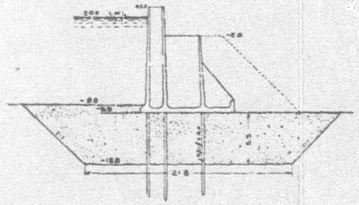


Plan ditto.



Quay Foundation on Pile.

Side View.



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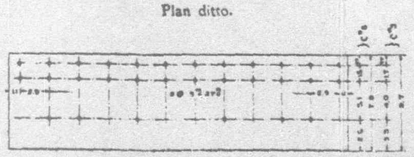
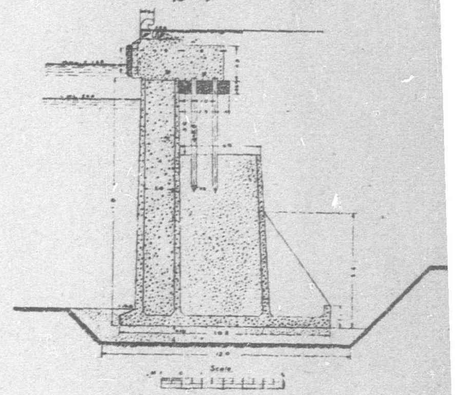


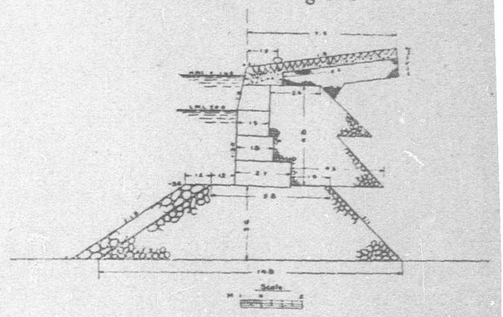
Cross Sections.

Quay Wall.



Scale.

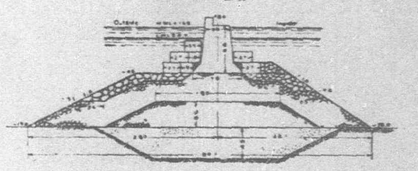
Wharf for Lighters.



Scale.

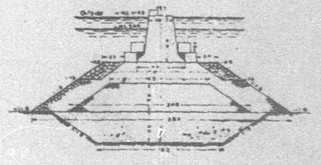
South Break-water.

Main Part.

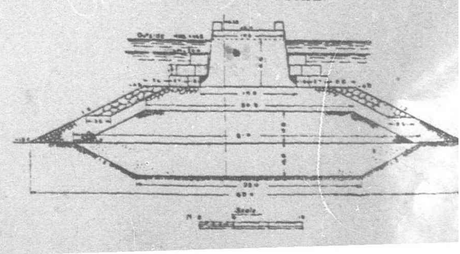


East Break-water.

Main Part.



Break-water Head.



Scale.

by the force of wave ; the next day we start the concrete filling in front chamber, putting a covering cap (built up with iron plate and angles) on the top of caisson, to prevent the water coming in even in case of high water, fitting a proper impervious material for packing between the caisson and the cap. After that, pumping out again by pulsometer of the sea water in the front chamber for which special concrete filling is to be commenced under pure day condition. This concrete is mixed by concrete mixer built up at the sea shore and chuted into skips on the deck of a barge which is pulled away by a tug boat and anchored along caisson side ; then the concrete is dropped down into front chamber by a crane. Repeating this, we complete the concrete filling of all front chambers and at the same time the back chambers are filled with good sand for the sake of economy.

We keep the caisson in that state for several months, considering that sinking of caisson may continue for that duration of time after the filling of sand and concrete. When sinking is finished we construct the superstructure on front top of the caisson ; this work completes all construction of quay wall. At first we expected the gradual sinking of caisson would be nearly 18 cm., but even on the day of finish of all works it was 15 cm. in maximum and 7.5 cm. in mean.

Ferro-concrete Caisson Adopted in Second Scheme of the Port Extension Work of Kobe.—This second scheme in which we are engaged at present was begun in March 1919. The outline of this scheme include the execution of quay walls of total length 5,764.0 m., and wharves and reclamation, and besides the completion of the breakwater to total length of 4,291.0 m. Thus, the construction of quay wall makes a good part of the scheme and the cost of quay wall is a most important factor of the total expenditures ; so we had to make careful investigation and studies in all directions with a view to select the most economical cross section. As result, we decided to adopt the caisson of unsymmetrical type described as follows.

The ferro-concrete caissons used in the first scheme were of two breadths of base : 10.3 m. and 11.0 m., and the inclinations of fore and back wall were both one twentieth ; after all they were of symmetrical forms, and the top breadth of the caisson was 6.85 m. Now taking in consideration the back pressure (earth and the additional), this breadth is too broad for a part of quay wall, because the caisson top remains 0.6 m. above low water level, which level is only about a meter under the quay wall top, where the back pressures are considerably decreased. By this reason the caisson top does not require the said thickness. This is a very vivid fact from engineering point of view, but in the first scheme of extension work, the similar symmetrical caisson was adopted as in case of quay wall work at Rotterdam, Holland, from the standpoint of obtaining sufficient stability in floating and easiness in handling. At the port of Marseilles also symmetrical type is adopted in the construction of quay wall in President Wilson Dock, and we believe it has come from the same consideration too. However, at the time of execution of our second extension work, the storm of international economic circles was at its apex, and the price of steel, and other different kinds of materials had risen up to nearly three times as much as that in the case of the first extension work ; formerly, the quay wall of great depth was completed at the rate of Y.1,100 per linear m. but later on, at the beginning of the second scheme, its construction cost rose up to Y.2,200—2,750 per linear m. It became quite necessary to execute the most economical cross section of walls. The steamer increased its dimension during last ten years and at the same time some improvement was done upon the form of its side, such as to chiefly increase the transporting capacity, and for this purpose the ship's side is usually vertical and sometimes swelled up at the bottom in some special cargo steamers. Therefore the front side batter of the quay wall along which the steamer of every kind is directly laid, must be at least almost vertical. However the force from back side makes it desirable for the wall to incline to the front side, from the standpoint of stability ; this form is not suitable for new steamers ; so the width of wall is to be extended backward, and as the resultant of back pressure acting on the wall is small at the top and gradually increases towards the bottom, the back surface of the wall must be extended inwards from top to bottom and the wall increase in thickness gradually towards the bottom. The wall thickness at its base depends on the bearing power of the sea bed, but in the case of ordinary nature of sea bed it is proper that the breadth of the wall at the base, from the toe to the heel of the caisson, be made equal to the distance from the toe (where pressure is maximum) to the line of zero intensity of pressure ; a greater thickness is unnecessary, because pressure intensity is negative beyond the zero line.

The caisson designed under this consideration and adopted in the second scheme of extension work is unsymmetrical of form, and the old form has been improved in the following points.

(1) Considering the latest form of big steamers, we determined the allowable limit of batter to 1/40.

(2) The thickness of each wall of the caisson should be sufficient for its handling, but from another point of view, as the outer face of caisson makes also the outer face of wall, the front wall of caisson must have sufficiently wider thickness than other wall parts, considering the attack of sea water and oxidation of steel ; from this reason we did not make the walls of equal thickness in spite of floating stability.

(3) From the consideration of L formed wall, the width of front chamber with permanent concrete filling constituting the body of the wall, has to be of sufficient thickness to resist the shock of steamers ; so we decided in this case 1.9 m. for larger size of caisson and 1.3 m. for the smaller.

(4) The position of backwall is decided from the necessity of keeping the buoyancy corresponding to its draft, which is necessary for floating and depositing of caisson.

(5) As the breadth of caisson base is to be decided by external force of back pressure composed of mainly earth pressure, we made it as broad as possible for the purpose of not increasing the intensity considerably at the toe of front base. From these relations, the base of caisson is prolonged further to backward of backwall and finally it finishes at a folding-up-rib of 0.6 to 1.1 m. height, and we fill up the space between back wall and folding-up-rib with sand and gravel as balance weight to make caisson body keep horizontal in floating.

(6) In the former caisson, the top breadth was large for the sake of easiness of floating execution, but in this type of new caisson, the height of back chamber was decreased by cutting off several upper meters, leaving only enough for floating and pulling away to the place where the caisson is to be sunk, and leaving only necessary free board for execution above draft line. As the wall thickness above this point is equal to the thickness of front chamber, if the width of front chamber at that point is smaller than the necessary wall thickness, the height of back chamber should be increased further.

The unbalance of unsymmetrical type of this form was remedied by loading the space between the back wall and the folding-up-rib.

Depositing Work of New Caisson on Sea Bed.—This improved caisson not only keeps an unsymmetrical form, but also its top of back chamber is a little lower than that of front chamber ; therefore the former is always submerged under sea water level even in case of sinking at lowest low water, while the front chamber is exposed about one meter above water level; therefore, for the sinking of caisson of this type, we put a cover on the top of back chamber to prevent the water from rapidly flowing in the chamber, and a proper method was arranged so that water can be poured in at any rate required. The admission of water requires good care and skill because the cross section at this part changes very suddenly : the horizontal water plane changes gradually for any position above the draft of the empty caisson up to the top surface of back chamber, and the change of buoyancy is also small ; but when the top of back chamber sinks just under water surface, the great change of buoyancy will take place at this moment, and the ratio of moment of inertia at the water plane against the displacement of caisson, or (I/V), is made smaller, therefore it diminishes the degree of floating stability considerably and it becomes very unstable even under slight shock. After that, as the power of buoyancy produced by the increasing draft of caisson has a tendency to act only on the front part, so the center of buoyancy by this effect displaces to front side of caisson and the front half of the caisson floats up and the back half down. When this change occurs somewhat rapidly, the caisson will be over-trimmed, and there remains much trouble to put it upright, and if the packing at cover of back chamber is not perfect, the water pours in too much and finally the caisson will be overturned ; but on the contrary if the cover is perfectly packed with proper care, there is no fear of water running in ; then by pouring the water only into front chamber, caisson gradually sinks down in upright position ; the increase of the displacement of front chamber balancing the quantity of water poured in, the moment about the center line of the caisson can be equally balanced

and after all the caisson reaches sea bed keeping in right state. For the pouring of water into the caisson we generally use arrangements such as pumps or siphons ; it takes thus several seconds or some time for pouring water in and moreover the water poured in does not keep still for some time in chamber and its movement exerts by inertia some temporary effect upon floating condition of the caisson. These several conditions will not allow exact coincidence between handling and the theory given above ; therefore we put a proper appliance on back chamber of the caisson to adjust the amount of water at any time. At the port of Kobe we built a cylindrical cover of iron plate and shapes, provided with a plastic rubber band on the under surface of the cover along the line of wall top, and tightened up by iron bolts to caisson wall, and also cemented with mortar to keep good tightness even in the water.

CAISSON YARD AND CAISSON MAKING.—In the second extension scheme, we had to adopt the same caisson yard arrangement as in the first scheme ; for we have a depositing dock which was used in the first scheme, so we again built up on the new place the same tooth-formed pier for caisson making, it having been necessary to remove the original one.

In the former scheme we built three sets of pier as caissons making platforms ; each set was composed of two concrete solid pier of length 21.2 m., breadth, 6 m. on both ends ; between these piers we constructed seven small piers of length 21.2 m., breadth 1.0 m., composed of hard wood piles, parallel to the solid piers, 4.5 m. C. to C. between each small piers ; every interval corresponds to the space just receiving the dock pontoon. The grid for caisson floor was built up resting upon the large concrete solid piers on both ends over these seven small piers. Surrounding this floor we erected two wooden stagings ; one of them having 128.5 m. length, 7.3 m. breadth, and 10.3 m. height above floor level, reaches three spans of the yard ; the other being of a movable type on the water front side of the yard, has a length of 40.0 m., breadth 4.0 m., and height the same as the fixed one, and it can be moved to the next span on rails.

On the new yard, the construction of the pier is almost the same as the old one, but on account of the large number of caissons to be made, which is two times as much as before, we constructed five spans, expecting eight caissons per span per year. According to the former experience, we replaced the fixed and movable stagings by a high tower crane of two tons lifting capacity, 20.0 m. radius, with four wheels on rails to travel along every span, and which can be engaged at any position required, in the work of buildng up and removing off the moulds and also transportation of the materials. The concrete is dropped by chute system, after lifting up by high towers built up on the head of every solid pier, a set of mixers being fitted at the foot of every tower. The moulds were all made of wood before, but this time, on account of great frequency of application, they are made of iron with small angles and thin plates.

As to dimensions of caisson, except the special shapes used for the corner part of the wall, five kinds of caisson are most commonly adopted as shown in the next table, according to the depth of quay wall.

CLASSES OF CAISSON

Class	*1*	*2*	*3*	*4*	*5*
Quay Depth, m.	12.0	10.0	9.0	8.5	7.2
Caisson Length, m. ..	35.0	35.0	35.0	35.0	10.2
Caisson Breadth, m. ..	11.7	10.2	9.7	8.8	5.9
Caisson Height, m. ..	13.7	11.8	11.0	10.3	7.3
Front Chamber Width, m.	1.8	1.4	1.2	1.2	9.0
Caisson Weight ton ..	1,944.0	1,629.0	1,508.0	1,412.0	1,081.0
Caisson Volume, c. m. ..	821.0	688.0	637.0	597.0	457.0
Filling Co . Vol. c. m. ..	749.0	526.0	423.0	398.0	356.0

Number of working days is different with kind of caisson ; for small caisson which is concreted in four layers, 12 days are required for completion of one caisson ; for larger one, concreted in five layers, 15 days are wanted ; therefore if we assume it takes 30 days for drying, we can deposit one caisson into sea in 45 days, so the rate of making becomes eight caissons per year per span and with five spans we can make up forty caissons per year.

CONCRETE FILLING AND SUPERSTRUCTURE.—After sinking the caisson, we soon fill up, for the purpose of acquiring good stability, the back chamber with sand and the front chamber with concrete after drying up by pulsometer pump. The filling concrete is mixed in the proportion of volume of cement 0.5, volcanic ashes 0.5, sand 2, gravel 5, by a mixer, which is set at the south shore of Hyogo reclamation ; it is loaded in several skips on deck of a barge and pulled to the site of caisson by tug boats ; there the concrete in skips is lifted up by a steam crane, and dumped down into the caisson chamber by opening the bottom of skip.

Several months after filling, we execute concreting for superstructure with stone facing. This concrete is mixed on land in the proportion of cement 1, sand 2, gravel 5, transported by barge and deposited by a crane.

COST OF QUAY WALL.- The cost for the construction of quay wall is as follows :

Kind of quay wall.	*Cost for linear meter.*
Quay wall 12.0 m. depth	1,620.0 yen
,, ,, 10.0 ,, ,,	1,350.0 ,,
,, ,, 9.0 ,, ,,	1,250.0 ,,
,, ,, 8.5 ,, ,,	1,190.0 ,,
,, ,, 7.2 ,, ,,	1,000.0 ,,

Comparing this with the quay wall of the same depth of the first scheme, we expected to save the expense of nearly 440.0 yen per meter ; but from the actual expense of 120 caissons already made, we shall be able to save more money than is estimated at present.

ESTIMATED COST OF QUAY WALL (IN DETAIL).

ITEMS	*Unit.*	*Unit. cost in yen.*	*12 m. quay wall.*		*10 m. quay*		*9.0 m. quay.*		*8.5 m. quay.*		*7.2 m. quay.*	
			Num.	*Cost in yen*	*Num.*	*Cost*	*Num.*	*Cost*	*Num.*	*Cost*	*Num.*	*Cost*
Concrete caisson	m3	38.85	22.9	889.67	18.3	710.96	17.0	660.45	15.9	617.72	12.2	473.97
Filling concrete	,,	12.35	18.0	222.30	15.0	185.25	11.9	146.97	11.2	138.32	10.0	123.50
Filling sand	,,	1.00	40.0	40.00	27.0	27.00	24.0	24.00	22.0	22.00	16.5	16.50
Concrete between caisson	,,	17.65	1.5	26.48	1.0	17.65	0.9	15.89	0.8	14.10	0.7	12.36
Stones for superstructure	,,	42.40	1.3	55.12	1.3	55.12	1.3	55.12	1.3	55.12	1.3	55.12
Concrete for superstructure	,,	17.65	2.6	45.89	2.6	45.89	2.6	45.89	2.6	45.89	2.6	45.89
Bed dredging	m.			44.00		44.00		44.00		44.00		44.00
Bed filling and levelling	,,			44.00		44.00		44.00		44.00		44.00
Caisson depositing	,,			22.00		22.00		22.00		22.00		22.00
Crane working cost	,,			8.25		8.25		8.25		8.25		8.25
Tug boating cost	,,			38.50		38.50		38.50		38.50		38.50
Dock working cost	,,			19.25		19.25		19.25		19.25		19.25
Miscellaneous	,,			11.00		11.00		11.00		11.00		11.00
				1,466.46		1,228.87		1,135.32		1,080.15		914.34
Reserved expense				153.54		121.13		114.68		109.85		85.66
Total cost				1,620.00		1,350.00		1,250.00		1,190.00		1,000.00

General Description of the Breakwaters in the Harbor of Kobe

The Kobe harbor is attacked by the waves from all directions, except from the north, which side is backed by the Rokko mountain (ht. 932 m.), especially by the ocean waves passing through the Kitan-Channel, these being strongest of them. So in order to protect the port from these waves in every direction and to keep an enclosed stillwater area, the following plan of breakwater was decided and is under execution since 1910.

(1)	South breakwater :	length	1,220 m. (containing both heads)
(2)	South jetty breakwater : total	length	345 m.
(3)	East breakwater, No. 2. :	length	1,513 m.
(4)	East breakwater :	length	1,149 m.
(5)	East breakwater, No. 1. :	length	1,332 m.
(6)	Temporary breakwater :	length	1,090 m.

On the total length 6,649 m., 3,882 m. were finished by November 31, 1929, and 1,332 m. are now under construction.

ESTIMATION OF WAVE FORCE AND ITS EFFECT TO THE BREAKWATER.—In attacking wave against the Kobe harbor, the longest fetch in the Bay of Osaka being only 17 miles in the direction of S.W., the strong translation wave very scarcely exist in this direction, but the ocean wave passing through the Kitan-Channel must be destructive for the Kobe harbor. The recorded wind velocity in this direction is not so large, but its power is considered to be most destructive for this port ; the wave height cannot be observed by instrument, but it seems to be about 2 m. or more from comparison with existing structures. These are the oscillation waves directly transmitted from ocean, which come to the Kobe harbor in the direction of S.E. When this wave breaks in white crest by the effect of a sudden rise of sea bed, wave height at its breaking moment is generally 1.5 or two times as much as that just before breaking. Therefore, under the assumption $H=1/20\ L$, the greatest value of H at the moment of breaking being equal to $H(1.5 + \pi\ H/2L)$, *i.e.* 1.6 H, at Kobe nearly 3 m., then the maximum pressure $\phi\ (C^2.\ \omega/2g)=\phi\ \omega.\ H=2\times1,027\times3=6,162\ kg/m^2$.

In case this breaking wave strikes on structures, the final velocity of the wave crest depends on height of fall more than initial velocity or orbital velocity of water particle ; this falling crest strikes on vertical wall at an angle of about 30°–45° ; so under this consideration the actual pressure on structures is 80% of max. pressure before described. From this standpoint, in Kobe breakwater design, the pressure on the structures at water surface can be assumed to be 4.8 tons/m². Taking south breakwater as example, the direction of jetty forms an angle of about 65° with straight line connecting of jetty forms an angle of about 65° with straight line connecting Kobe and Kitan-Channel ; so the wave pressure normally applied to breakwater decreases to about 82% and it corresponds to nearly 4.0 tons/m². The wave pressure on this water surface position gradually decreases towards the upper and lower position of water plane, though there is found sometimes opposed values in the individual tests of measurement ; but in the deep water wave generally discussed with, it is recognized to make a parabolic variation which is nearly equal to the change of rate of energy owing to the orbit motion. Now in Kobe breakwater, assuming that the max. pressure before described decreases to 90% at the 3 m. above water line, and to 45% and 30% at 3 m. and 4.5 m. under water level respectively, judging from the Experimental wave pressure curve, the external force makes the reaction of 18.6 tons/m² at the harbor side toe at the base of caisson, and it nearly corresponds to 10% more than mean pressure intensity.

EAST BREAKWATER.—East breakwater belongs to the oldest construction of Kobe breakwaters. This breakwater is 1,149m. long and 454m. distant from pier head at the shortest distance ; the eastern part, 263m., is a straight line, the next 840m. are in a curve of 1,270m. radius and the western part, 46m., is a straight line again. Both ends (29m. length each) compose breakwater heads, so the remaining part 1,091m. in length is the main part of the breakwater. Eastern part is in 10m. depth, and western part and the head in 11m. depth. Equipments necessary for execution of this breakwater are yards for making ferro-concrete caisson to be sunk down, and concrete blocks for protection of caisson footing. Caisson yard is arranged with one tooth-formed pier and wooden staging on northern side in order to utilize the same depositing dock ; it is almost of the same construction as pier for quay wall caisson, the only difference being that while three spans are used for quay wall caisson, only span is accommodated for breakwater caisson. Block yard and mixing yard of filling concrete are accommodated in a place a little above the quay wall accommodation.

As to the construction of the breakwater, it is made with rubble on sea bed : the caisson was then brought on the top of rubble ; the inside and top of caisson are filled with concrete in place, and at back side of caisson, concrete blocks are piled up for protection of caisson footing. Following description will explain in detail.

Rubble mound : The rubble for the mound was classified in three classes, *i.e.* below 56 kg., between 56 and 300 kg. and above 300 kg. per piece. It was expected that the sinking of breakwater would more or less occur by self weight in the future, and therefore the level of rubble was made higher than required in final. When work was extended on the next part after about six months, it was found that sinking was 6.1 m. in max. So, it was acknowledged that sufficient consideration should be given in the future to the execution of this work.

It must be said that mud thickness is so deep (some 3 m.) that rubble sunk down by loading cannot penetrate this mud and reach the sand layer of greater bearing power. Therefore, we must be satisfied with making it balance by increasing bottom area of rubble mound, and thus decreasing pressure intensity on the mound base. This kind of construction brings the jetty in an unstable condition similar to the condition attained on a kind of floating foundation. For the sake of attaining a reliable stability of rubble mound without spending a long time, we adopted the method of loading on every section of rubble mound. This loading is to be repeated several times, commonly three times or exceptionally four times, until rubble foundation attains probable bearing resistance. As loading, piling up of concrete blocks of seven layers is used and the pressure on rubble base is nearly 17.0 tons/m². In addition to this, if it gets shock from wave, pressure intensity of 25.0 tons/m² will exist on harbor side.

In the original design, the ferro-concrete caisson to be put on rubble jetty top was 6.3 m. in height and breadth, and 12 m. in length, weighing 370 tons in air, but owing to the reason given before, the form of caisson was changed, the breadth of caisson top being made 3.6 m., having 1.3 m. footings on both its sides, the bottom width increased 6.9 m. and the height decreased to 5.4 m. ; also central longitudinal partition wall to be removed, and the caisson to be divided into four compartments by three transverse partition walls and side walls to be stiffened by building small walls like ribs near its bottom. Corresponding with this, the height and breadth of the rubble mound were increased, top being at 3.6 m., top width 24.5 m., both side slopes 1/2, and in central part of the mound, about 56 kg. rubble per piece were used, and in both side slopes above 7.6.m., 300 kg. per piece rubble used ; moreover on both sides of caisson large concrete blocks were piled up as protection of the caisson.

CAISSON MAKING.—The pier and grid are quite similar to those for quay wall caisson, but the surrounding staging in this case is lower, corresponding to caisson height. As the breakwater caisson is to be concreted in three layers, the staging was constructed in three steps. The concrete was mixed on ground floor, lifted up by electric elevator, transported by light cars on each step floor and dropped down by chute from required position. Concrete proportion was cement, 1 : sand, 2 : gravel, 4. Moulds were built up for facilitating the casting of the concrete in each layer, and each layer was connected with the next by means of bolts and angles.

DEPOSITING OF CAISSON.—The method of sinking and filling in of the caisson was nearly the same as that for quay wall caissons. Filling concrete for caisson had the proportion of cement 0.5, volcanic ashes 0.5, sand 2, gravel 5.

BREAKWATER HEAD.—Breakwater head is attacked by stronger wave force than other parts ; moreover as a lighthouse is to be erected on its top, the top area requires to be suitably large. Each head of breakwater was made by two caissons of this form placed in parallel. Rubble mound was spread on base area and loading was repeated on this to attain the safe load distribution. The lighthouse erected on top is an iron framed tower ; the lantern is an acetylene gas single light with reducer and has a burner of the size 56 litre. Height of lantern is 13 m. above L.W.L. and it flashes out red and green colored light lasting 1-1/2 seconds in every 4-1/2 seconds.

South Breakwater.—South breakwater was constructed almost in the same way as east breakwater ; *i.e.* the classified rubble was first put on the sea bed, outside slope being 1/2 and inside slope 1/1.5, top of rubble mound levelled at 5 m. under L.W.L., concrete caisson settled, its top being 1.8 m. above L.W.L., and the caisson filled with concrete ; on the top a parapet wall is to be constructed. Besides, on outside footing of caisson, 13 and 17 tons concrete blocks (1.2×1.8×2.7m. and 1.5×1.8×2.7m.) were piled up and the back was also protected with rubble. The dimensions of the caisson are: length 14m., height 6.6m., bottom width 7m., top width 3.6m.; the inside is divided in four compartments by three transverse partition walls, wall thickness being 18-33 cm., base 26 cm. thick. The caisson bottom is fitted with longitudinal rib wall, 0.55 m. high and 0.36 m. thick. Comparing this with the east breakwater caisson, the top width is the same and the only difference is that the height is 6.6 m. instead of 5.5 m. The foot protecting blocks were increased in number.

Afterwards as the caisson of longer length was considered to be better in view of the advance of works, its length was increased from 12 m. to 14 m. which was the length allowable in the yard. The 95 caissons used for the south breakwater are classified as follows, with regard to their forms :

Kinds of caisson	*Number*
Length 12 m. caisson	66
Length 14 m. caisson	24
Large cais. on breakwater head	2
Special	3
In total	95

Loading.—In order to obtain stable sinking of rubble, the concrete blocks were piled up for loading, and taken away, this being repeated generally three times as in the east breakwater. The sea bed in the position of the south breakwater is covered with a thick layer of mud where rubble sinking should be extraordinary. The three times loading was not sufficient to have stable mound and at last four times loading was repeated several times. Increase of number of loadings expands the expense and time, so we had to find some proper method to diminish the number of loadings. It was expected that if the soft mud on sea bed were dredged as in the case of quay wall, replaced with good sand, and then the rubble deposited over it, the sinking would be reduced very much ; so the testing was started on a part of the breakwater.

The test showed following results :

(1) The sinking of mound was very much reduced, and the quantity of rubble saved nearly 25%.

(2) The number of repeating of loading the mound can be reduced, and the labor and time necessary for it can be saved accordingly.

Owing to the above, this method was adopted thereafter, and gave good results.

The total amount of rubble actually needed by the south breakwater construction was 543,500 cub. m. instead of 364,300 cub. m. of calculated volume.

The Cost of Construction of Breakwaters.—The cost of the east breakwater is as follows.

(1) Cost for main part of breakwater per linear meter.

Breakwater depth in m.	*Length in m.*	*Year*		*Cost in yen.*	*Cost lin. m.*	*Remarks.*
		started.	*finished.*			
10	455	1910	1914	563,898		Except the part of parapet wall.
11	636	1910	1918	769,160		
			Total ..	1,333,058	1,222	

(2) Cost in detail for lower part of breakwater.

(*a*) Part of depth 10 m. :

Name of parts	*Length in m.*	*Cost in yen.*	*Cost per m.*
Rubble mound	455	254,294	559
Loading	455	53,745	118
Surface plaining	455	15,374	34
Total ..		323,413	711

(*b*) Part of depth 11 m. :

Name of parts	*Length in m.*	*Cost in yen.*	*Cost per m.*
Rubble mound	636	366,866	577
Loading	636	42,635	67
Surface plaining	636	24,318	38
Total ..		433,819	682

(3) Cost in detail for upper part of breakwater.

	Part of depth 10 m.			*Part of depth 11 m.*		
	No.	*Cost.*	*Cost for lin. m.*	*No.*	*Cost*	*Cost for lin. m.*
Super Body	455 m.	115,395	254	636 m.	162,291	255
Caisson No.	37.2	—	—	52	—	—
Caisson making ..	37.2	76,700	168	52	104,903	165
Inside filling	37.2	5,502	12	52	8,536	13
Fill. concrete	3,027 m3	23,100	51	6,137 m3	30,747	48
Fill. blocks	372	8,303	18	581	13,154	20
Tug boat	—	1,788	4	—	4,949	7
Footing Protection ..	455 m.	125,087	275	636 m.	173,046	272
Blocks	2250	114,352	251	3150	155,770	244
Block piling	2250	9,481	21	3150	13,228	20
Tug boat	—	1,254	3	—	4,048	9
Total ..		240,482	529		335,337	527

(4) The south breakwater is now achieved up to 90% of total works, and its construction cost is as follows.

Classification	*Unit*	*Cost in yen*	*Remarks*
Breakwater main part	m.	2,860	2,860 yen per linear meter.
Foundation	,,	1,520	
Rubbling	,,	1,310	
Loading	,,	155	
Rubble surface levelling	,,	55	
Super boby	,,	1,135	
Caisson making and placing ..	,,	375	
Caisson concrete filling	,,	220	
Footing protection	,,	485	
Parapet wall	,,	55	
Miscellaneous	,,	205	
Tug boat	,,	175	
Miscellaneous	,,	30	

Conclusions

We may deduce the following conclusions from the experience of the east and south breakwaters at the Kobe harbor.

(1) On sea bed covered with a thick mud layer, it is possible to decrease considerably the sinking of rubble mound by previously dredging the mud and replacing it with sand, the rubble being deposited on it.

(2) On sea bed covered with a thick mud layer, the breakwater constructed on it should be considered as resting on a kind of floating foundation ; it continues to sink down gradually with the lapse of time and if it is attacked by shocks beyond the limited amount, sudden sinking can never be avoided.

(3) The amount of rubble sinking into soft mud in the construction of composite-typed breakwater on a soft foundation such as in the Kobe harbor, will be in the range of 50%—20%.

Diesel Locomotives for S.M.R.

Mr. K. Hanai, one of the engineers of the S.M.R. Japanese State Railways who was sent to Europe in connection with the purchasing of Diesel locomotives on his return recently expressed himself as follows :

In Germany, there are 80 Diesel locos in operation. The disadvantages of the Diesel engine are that they are noisy, give out much soot, and are attended with violent vibration.

If these defects can be eliminated, the Diesel loco will be just the thing for the super-special express in Japan. The obviation of feeding the engines with water will make it very convenient. In Russia, which is noted for water scarcity it is extensively popular. The use of the Diesel engine in Russia and South Manchuria where heavy oil is within easy access will enhance the working efficiency besides saving expenses.

The S. M. R. Co. has a couple of its officials in Germany to order two Diesel locos which are expected in Dairen before the end of the year, where they will be employed for shunting purposes, to begin with.

In Japan proper, there is an ample field for Diesel passenger cars (outside the Diesel locos) because of their exceptional suitability for interurban traffic. Two locos of the same type have been ordered by the Railway Ministry, Tokyo.

When the design and Specifications of the Diesel locos are learned by the Japanese engineers it is expected that they will prove capable of developing a new type that will compare favorably with those of German-make.

In view of the General tendency to employ Diesel locos and passenger coaches, it may be worth while for the S.M.R. Co. to construct a plant for the manufacture of Diesel engines.

The Present Status of the Telegraphs and Telephones in Japan*

By SANNOSUKE INA A, Director General of Telegraph and Telephone Engineering in the Department of Communications

THE telegraph and telephone business in Japan has been exclusively owned and managed by the Government since its introduction. It shows rapid and sound growth under an able administrator in the Department of Communications, a growth corresponding to the social demand for means of communication.

The telegraph business was introduced to Japan in 1869 and the first telephone exchanges were opened in Tokyo and Yokohama in 1890. Later on, the wireless telegraph business came to the public service in 1902. Since then, they have made remarkable development and the recent technical improvements are all adopted in every line.

The Telegraph Business

On the telegraph business, the statistics at the end of March, 1930, shows :

Number of telegraph messages year ..	59,000,000 (outgoing)
Number of telegraph messages year ..	58,000,000 (incoming)
Number of telegraph offices	6,531
Number of telegraph circuits	4,120
Length of telegraph wires (Formosa, Korea and Saghalien excluded)	321,368 km.

Besides these lines and equipments, there are submarine telegraph cables extending to about 2,900 mm. between the inland and colonies or foreign countries, such as the Tokyo-Guam cable to America, the Nagasaki-Shanghai cable, the Naha-Yap cable, Sasebo-Taingtau cable, the two Dairen cables, Formosa-Fukushu cable and Toyohara-Alexandrowski cable, except the two Shanghai cables and two Vladivostok cables owned by the great Northern Cable Co.

Among the new equipments recently adopted, the printer of Japanese ideographs is one of the most remarkable developments, which has been devised by our engineers and is manifesting its excellent functions as a high speed telegraph system. As the Japanese alphabet consists of 48 characters, the mechanical and electrical features of the printers are so complicated that a six unit code is necessary in place of the five unit code in the European printers. After the endeavors of many years, we succeeded in overcoming the difficulties to bring the printer of Japanese characters into practice, and at present about 90 printers of Japanese character are set in operation in telegraph circuits, handling over 2,000 messages per circuit on an average.

Mr. S. Inada, Director General of Telegraph and Telephone Engineering in the Department of Communications

The picture transmission service was started on the occasion of the Imperial Enthronement in 1928 on telephone lines specially assigned for newspaper enterprises of which the two adopted the Siemens-Telefunken system and the one the Nippon Electric Co.'s system. With the home-made apparatus, the service has been opened to the public between Tokyo and Osaka since the end of August of this year. The Nippon Electric Company's system has various merits such as simple synchronizing devices, the screen for the light spot etc., compared with the well-known Berlin, A. T. & T., and Telefunken systems. Notwithstanding the very simple and light construction, it has displayed excellent results in both wire and wireless transmission.

To cope with the rapid growth of the telegraph business, the central telegraph offices in large cities, such as Tokyo, Osaka and Kobe, were removed to new offices, in which every improved telegraph system in adopted, together with auxiliary facilities like belt conveyers, pneumatic tubes, code carriers and automatic exchange of the urban and suburban circuits, in order to shorten the transfer time of messages in the offices.

The Telephone Business

The telephone business is one of the enterprises, which has grown with big strides in our country, especially with the large extension plan after the World War, and more than 400 million yen have been already invested.

With a view to undertaking the extension of the telephone business to meet the earnest demand, our Government at first took the system to make the subscribers offer a part of the cost, of which the sum was sometimes changed on account of economical conditions. In the third extension scheme recently reframed, this sum is to be decreased yearly and come down to zero at the end of the last year of the scheme. This scheme covers 12 years to increase subscribers by 646,000 and the toll telephone lines by 247,000 km. at the approximate expense of Y.627,-354,000.

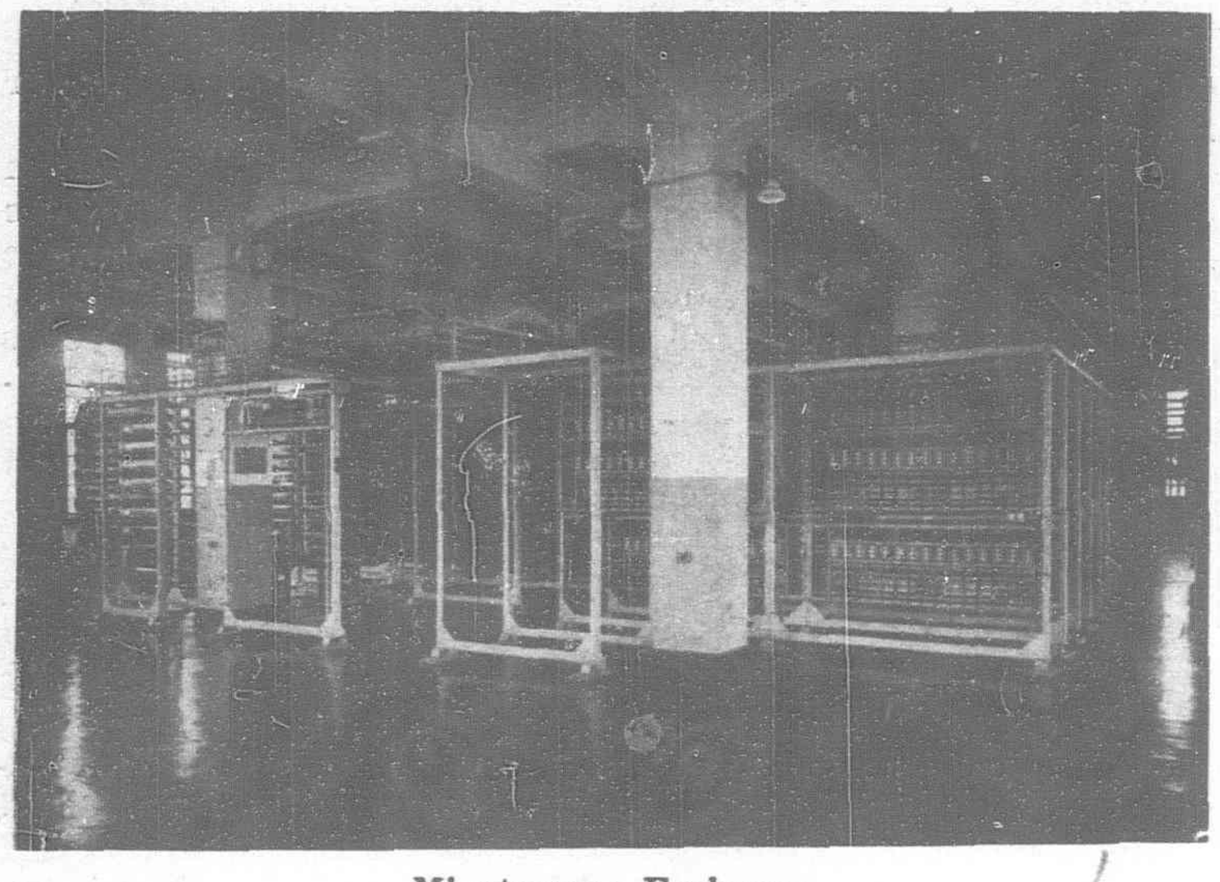
The status of the telephone business at the end of March of 1930 is shown in the following statistics :

Siemens-Halske Cordless B-Board, Fukushima Office, Osaka

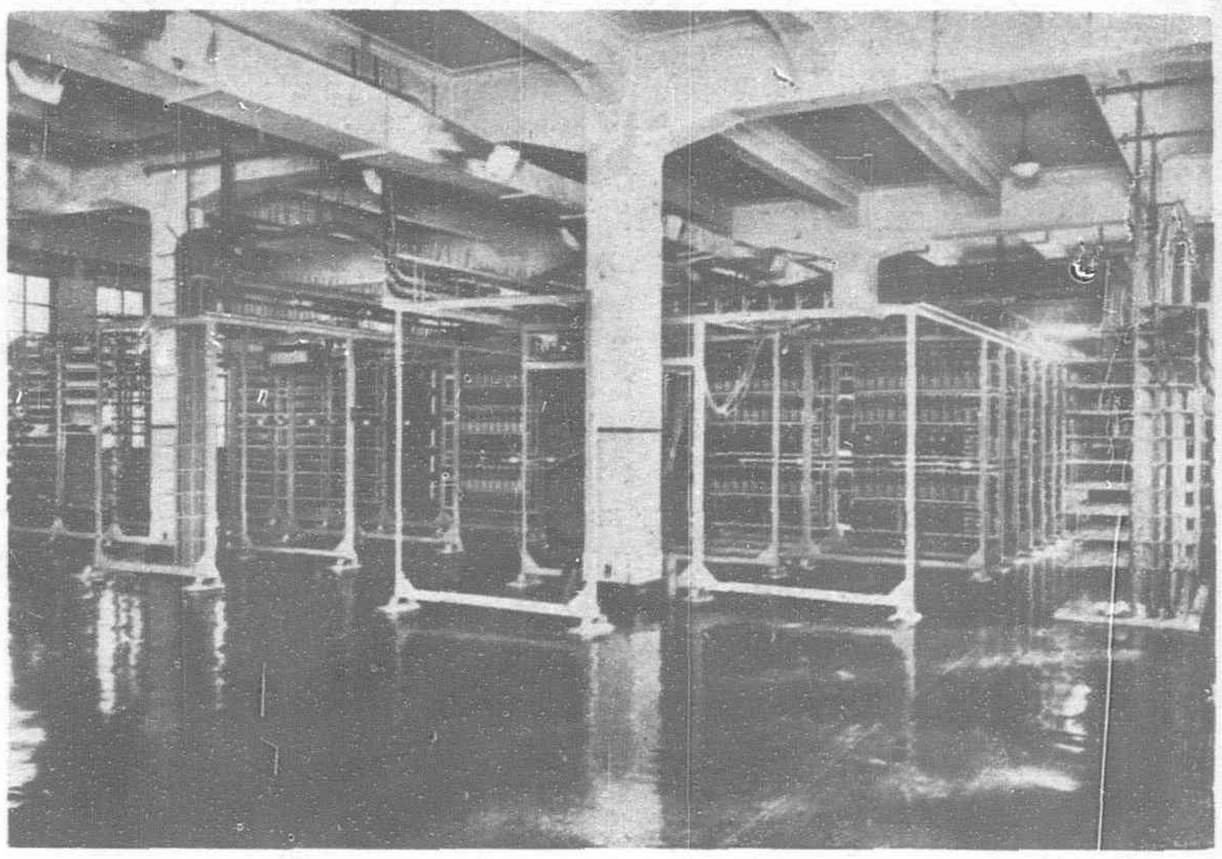
**Japan Monthly*

AUTOMATIC TELEPHONES IN JAPAN

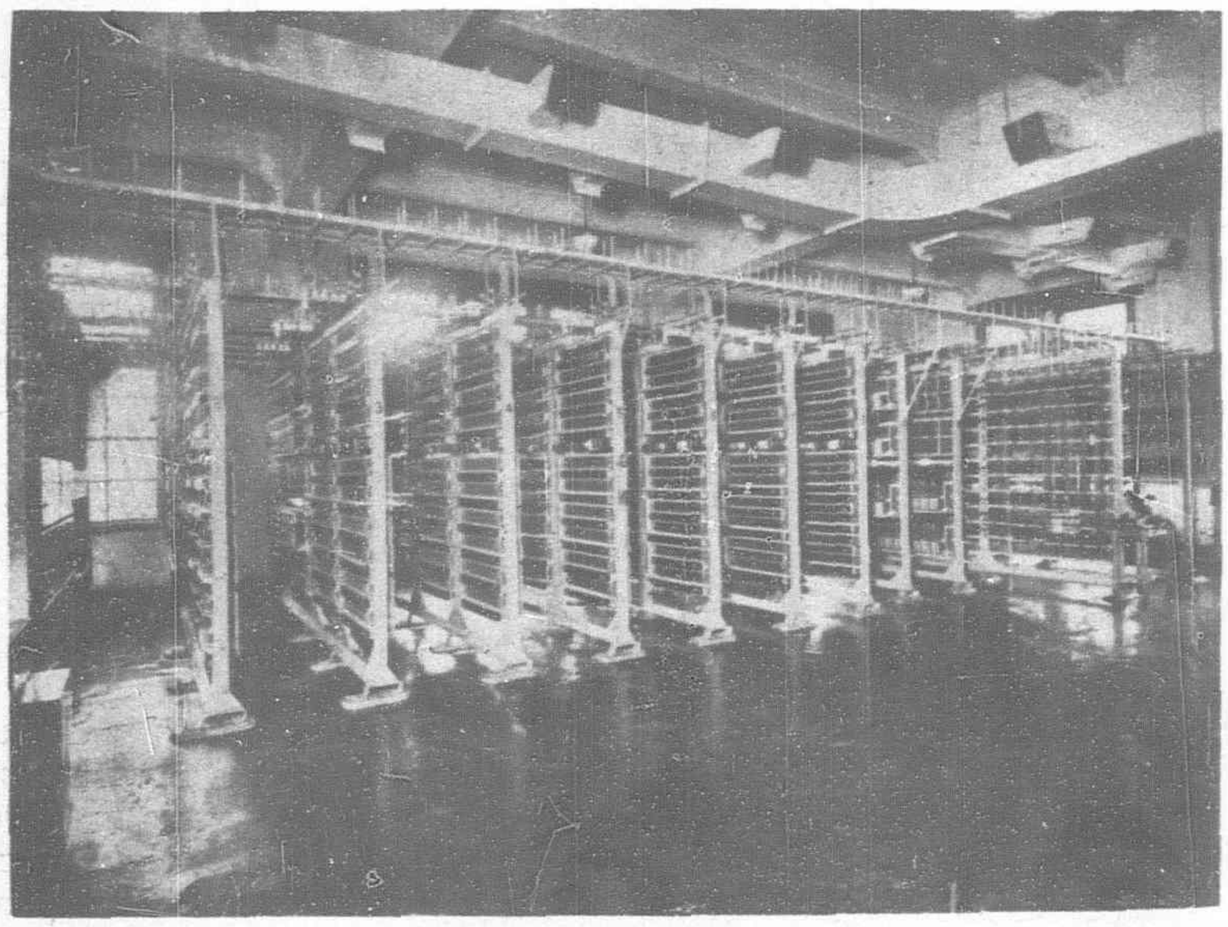
Osaka Automatic Exchanges Equipped with Siemens-Halske Apparatus



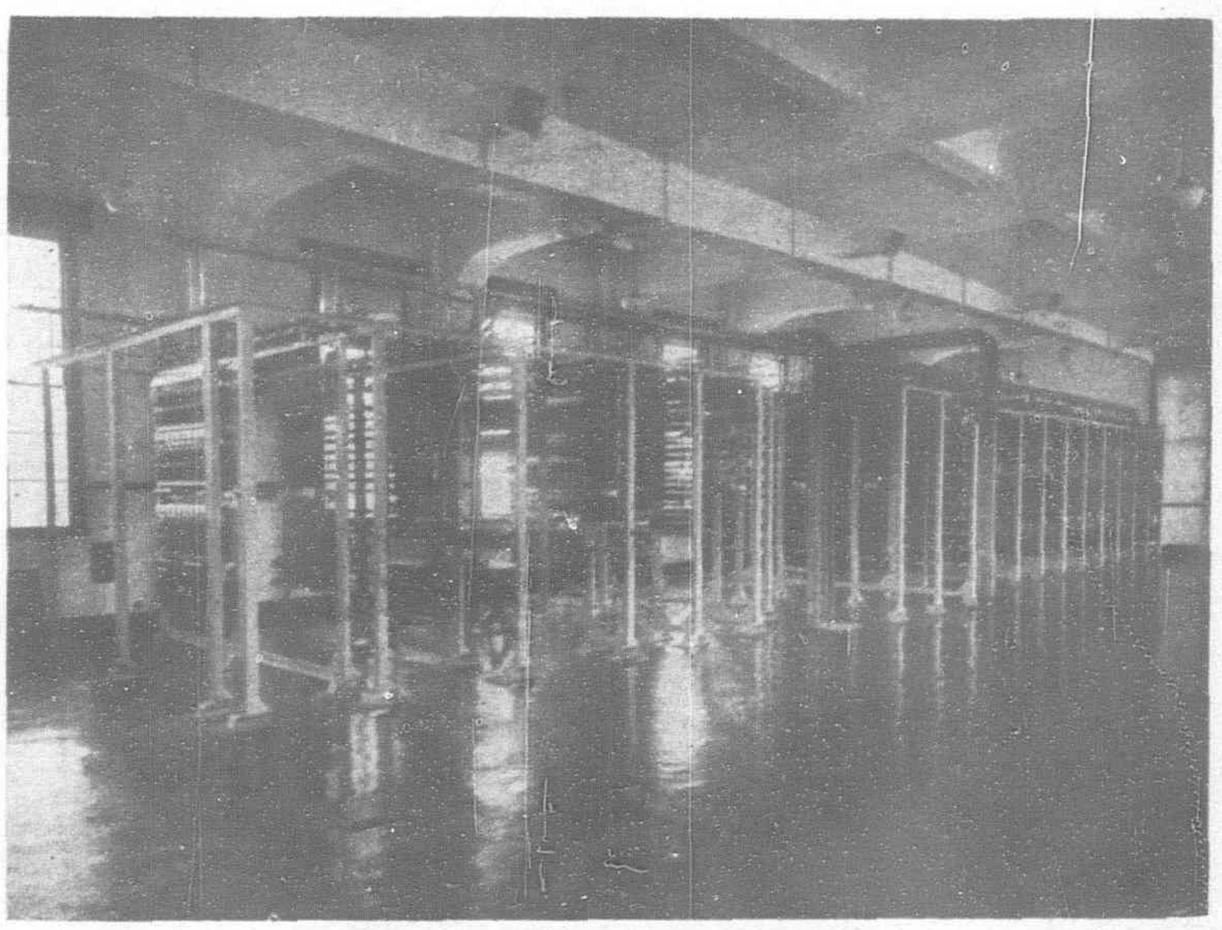
Minatogawa Exchange



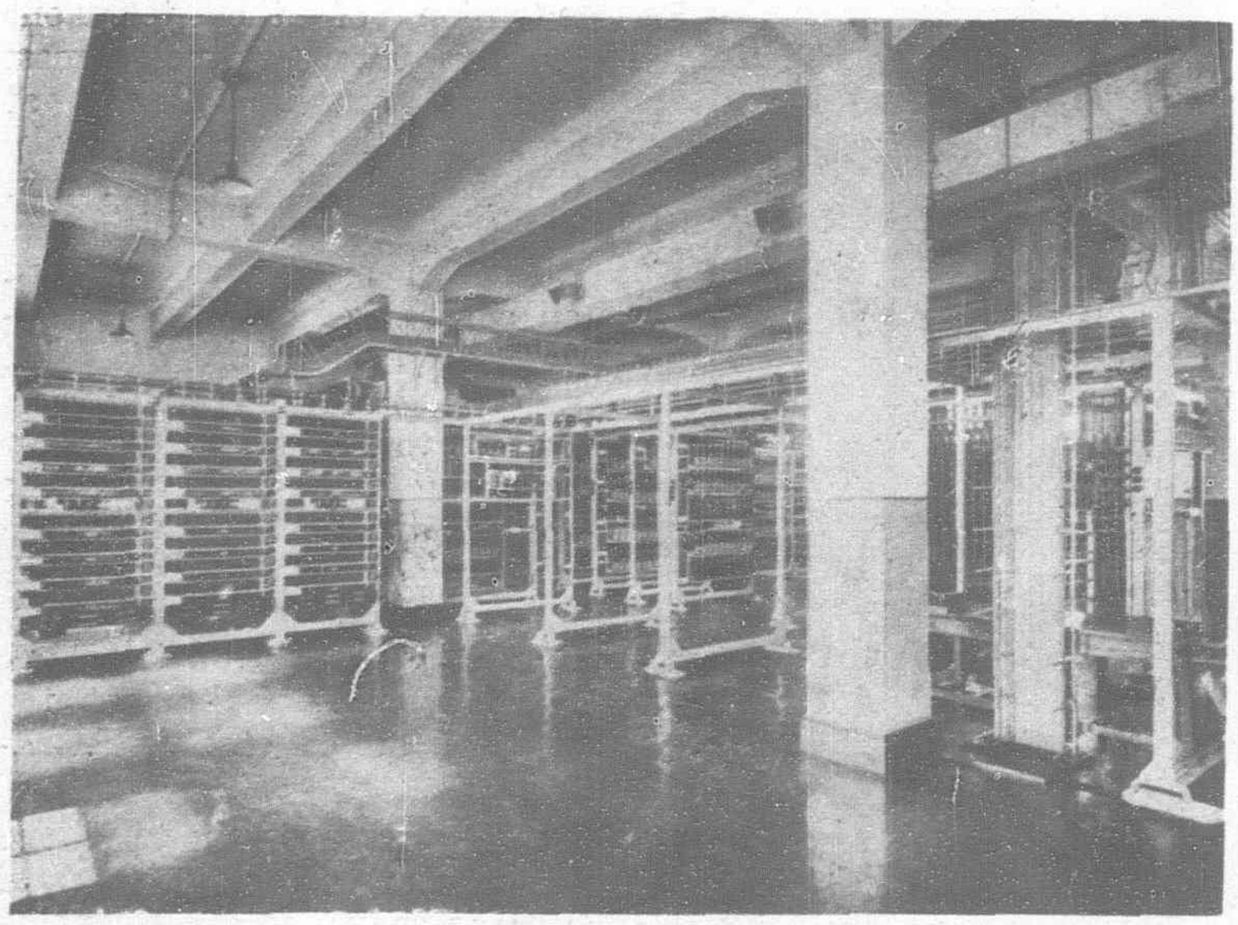
Tennoji Exchange



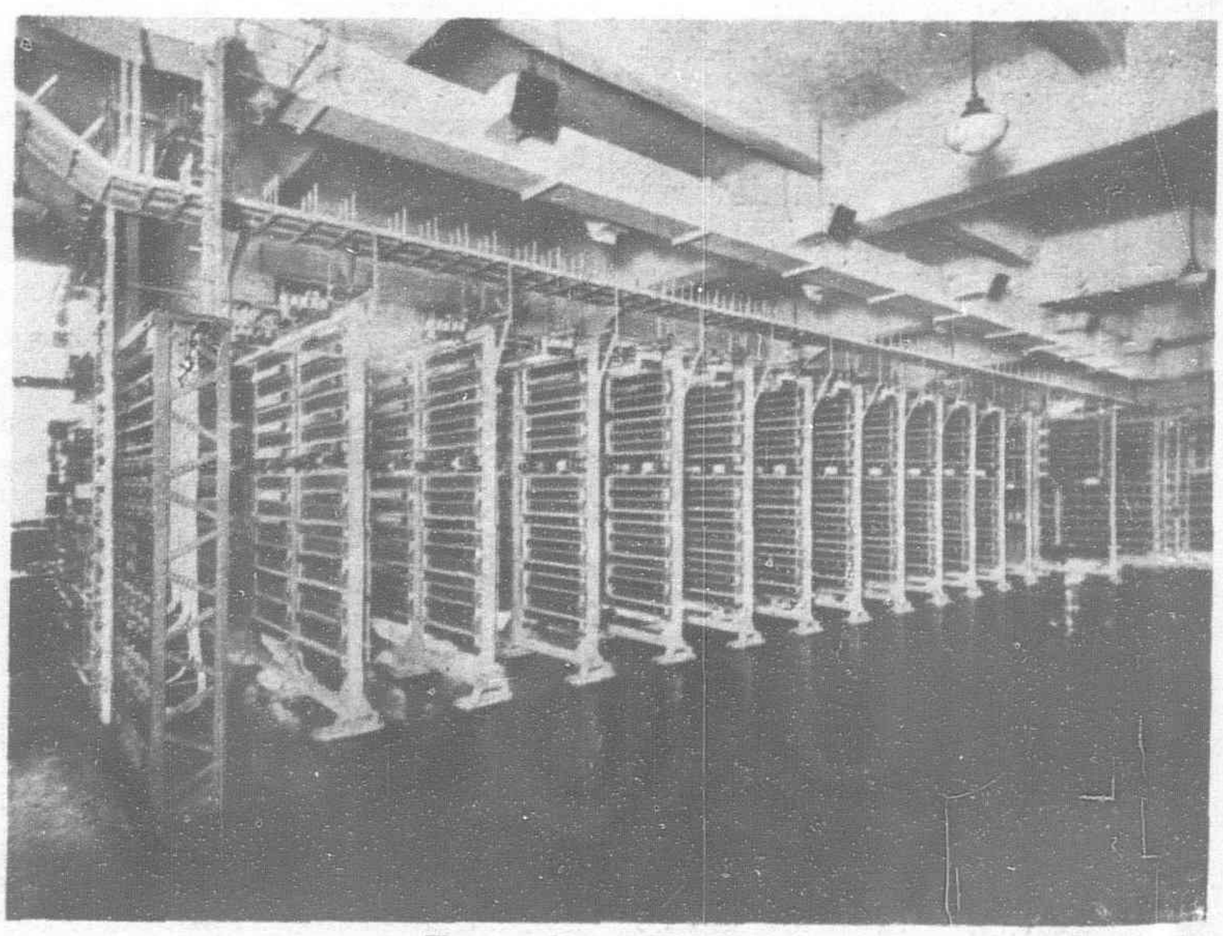
Sumiyoshi Exchange



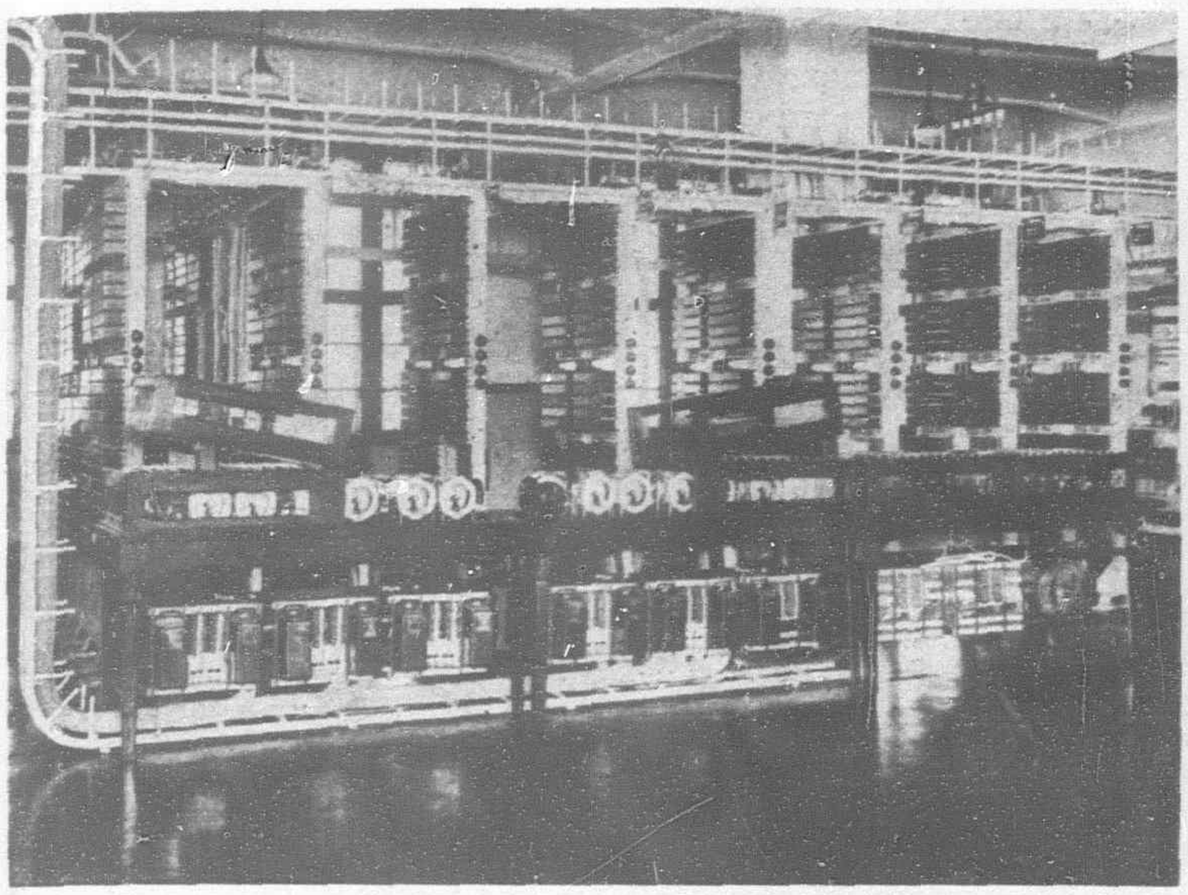
Suma Exchange



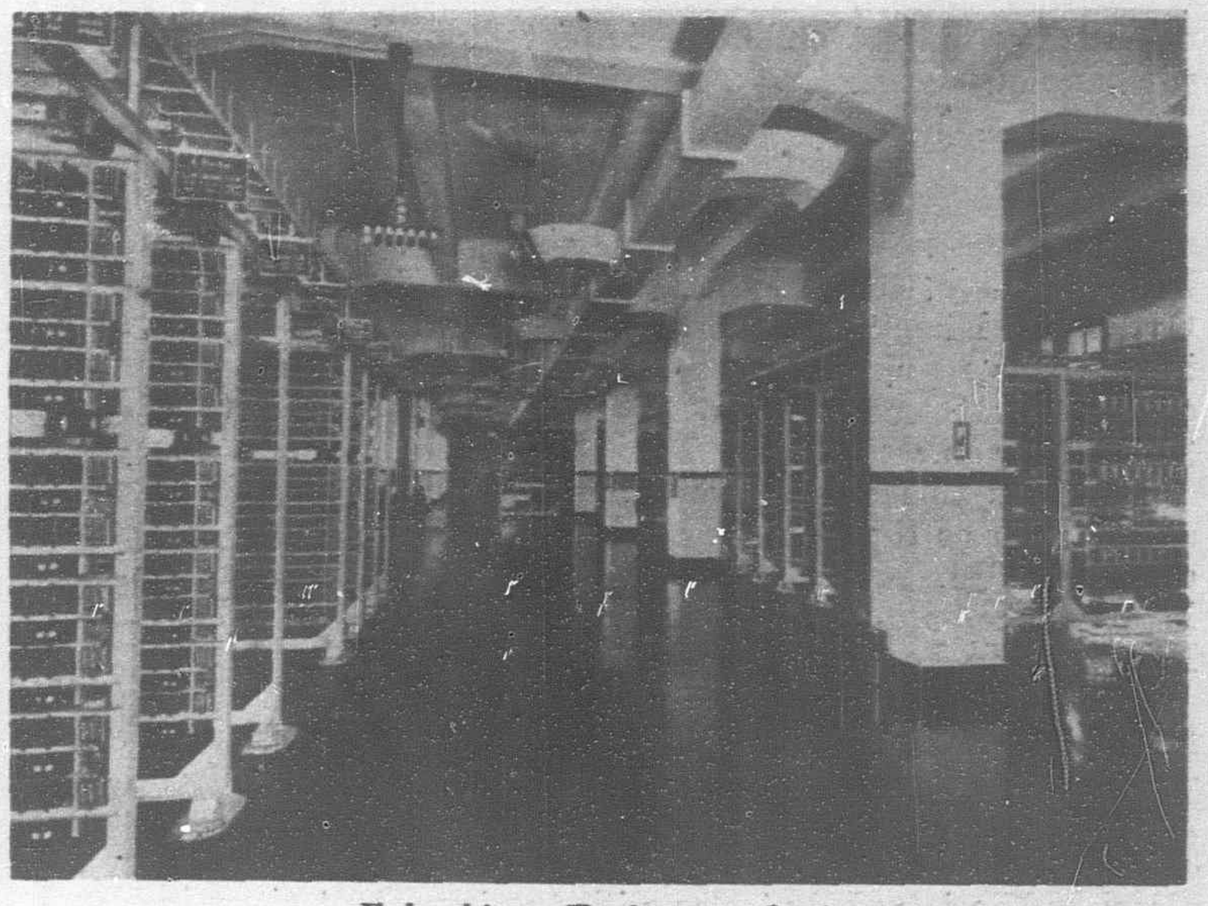
Horikawa Exchange



Tenguchaya Exchange



Siemens-Halske Impulse Sender, Fukushima Exchange, Osaka



Fukushima Exchange, Osaka

Number of telephones	..	..	862,712
Number of telephone exchanges	..	..	2,967
Number of toll telephone circuits	..	..	7,642
Total length of toll telephone lines	..	..	388,000 km.

Among the most marked progresses which have been recently made in the telephone business, are counted the adoption of automatic telephone system and the extension of long distance telephone cables. It is a recent tendency in Europe and America to cut over old manual exchanges into automatic exchanges, due to the economical aspects of the latter system recently achieved, and the inflation of wages. In our country, the first automatic exchanges were opened to the public in 1926, as part of the reconstruction work of the Tokyo and Yokohama manual exchanges damaged by the last earthquake disaster.

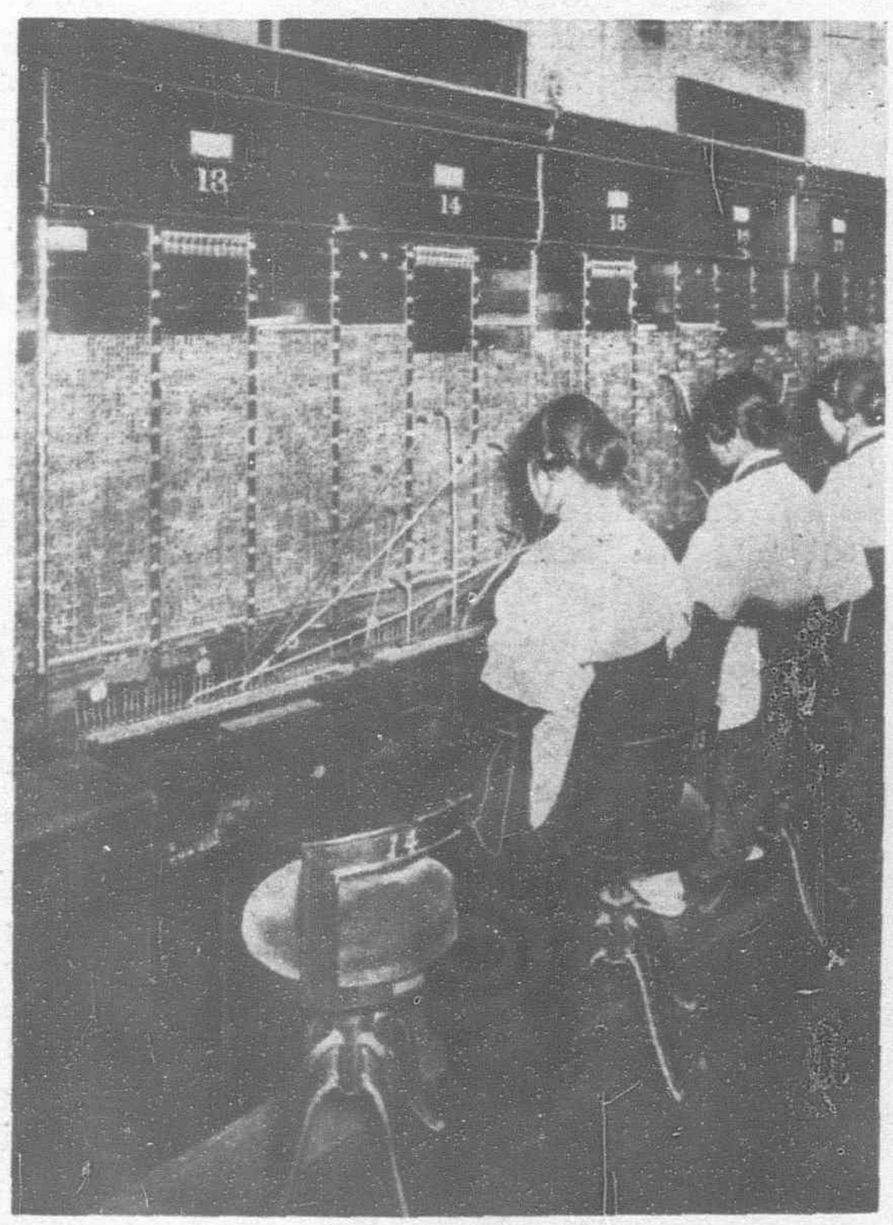
Prior to the adoption of the automatic telephone system the Department installed a private automatic branch exchange of 300 lines in 1921 to investigate whether this system is adaptable to our semi-tropical climate or not. As a result, we decided to make use of the Adsole desicating apparatus invented by the Institute of the Physical and Chemical Research to keep low humidity in switch rooms. Adsole is manufactured from the acid earth produced in the district of Echigo and has the property to absorb moisture exceedingly well at ordinary temperature without any change in itself, its absorbing power being over 15 per cent of its own weight.

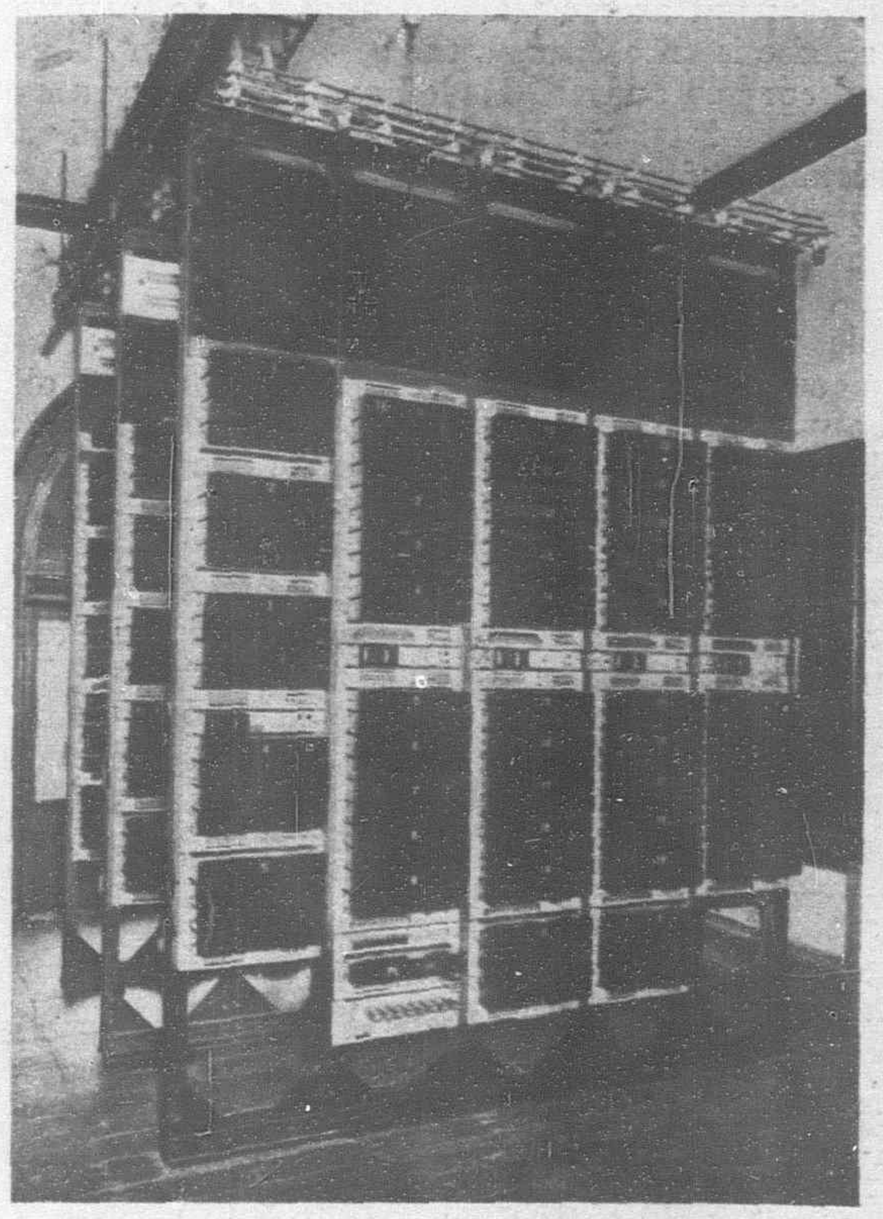
Thereafter, the automatic telephone system was introduced to replace the manual exchanges expired in large cities such as Tokyo, Osaka, Nagoya, Kyoto, Kobe and also their suburbs.

At the end of March, 1929, the number of subscribers of the automatic system ran up to 73,000 about 11 per cent of the total number of subscribers in our country. With the introduction of the automatic telephone system, the manufacture of automatic telephone equipments has also developed, although all of them were supplied in the early period by foreign manufacturers in Great Britain and Germany. At present all the equipments of the Strowger system are manufactured and supplied by our home makers, the Nippon Electric Co. and Oki Electric Co.

Following the recent technical developments of the telephone repeaters and loading coils, long distance telephone cable networks have been considerably extended to replace the aerial telephone lines as the means of securing the sure and more economical service for heavy traffic. Especially, the long distance cable networks have to be constructed to solve the serious problem of the congestion of power transmission lines and several communication lines due to the geographical configuration of our country.

International telephone networks have recently made the remarkable progress in Europe and America together with the development of radio telephone links. As the first step of these long distance telephone cable networks the Tokyo-Okayama cable, 750 km. in length, was set to work early in 1922, but owing to the great earthquake disaster in 1923, the work was thoroughly upset and delayed, and the Tokyo-Kobe section of 610 km. in length was completed in October 1928, just before the ceremony of the Enthronement in Kyoto. As the second step, the work is further being continued to extend this cable to Shimonoseki in the south and to Aomori in the north. This





Siemens-Halske Call Indicator, Honkyoku Exchange, Osaka

cable is the longest and most important one and passes through the mainland connecting most of the large cities, such as Tokyo, Yokohama, Nagoya, Kyoto, Osaka and Kobe. It principally consists of 54 pairs of the conductor of 1.3 mm. dia, and 130 pairs of 0.9 mm. dia., and is loaded by the loading coils of the iron dust core type at the interval of 1,830 km. The repeater stations were built at Tokyo, Yokohama, Ashigara, Ejiri, Toyokawa, Kameyama, Osaka and Himeji, and the two wire and four wire repeaters were installed as required for the present demand. The total amount of the investment for this cable system is counted to be about 30 million yen.

Besides this cable, there were installed local toll telephone cables such as the Osaka-Kobe cable in 1922, Tokyo-Yokohama cable in 1913, Kyoto-Osaka cable in 1924, Moji-Fukuoka cable in 1930, Sapporo-Otaru cable in 1930, Tokyo-Hino cable in 1926, Niigata-Nagaoka cable in 1929, etc.

The total length of the toll telephone cable is about 1,800 kms at the end of March 1930. With the accomplishment of the present extension plan of the toll cables, the toll telephone cable networks will be thoroughly completed all over our country, enabling us to easily communicate by telephone not only with any places in the inland, but also with the important cities in Korea, Manchuria, Saghalien and Formosa (with the radio link).

According to the geographical features of our country, we have to lay many submarine telephone cables to connect the mainland with its surrounding islands, and also to connect our country with colonies such as Korea and Saghalien. At present there are submarine telephone cables of about 800 km in total length, of which the two Aomori-Hakodate cables (about 65 km long each) and the Fukuoka-Tsushima cable (about 200 km long) are the most important.

The former were intended to connect the main island with the Hokkaido, which were keeping touch with each other by the wireless telephone for the railway ferry steamships.

The one of them was laid in 1926 and the other in 1928, of which the constructions are quite the same as to the balata insulation, continuous loading and quad composition. Their length is about 65 km. and they are connected with the coil-loaded land cables of about 45 km. in length on the Aomori side and 27 km. on the Hakodate side.

The Fukuoka-Tsushima cable is part of the Korean Strait cable, which offers the means of communication between our country and the Continent of Asia. As Tsushima island as situated in the middle of the Strait, the part between Tsushima and Fuzan will be laid in the next year. For the sake of safety, we took the route *via* Tsushima and laid the balata insulated continuously loaded one quad cable ; but as the traffic is expected to increase rapidly when the service is once opened, the second Korean Strait cable will be of lead covered and coil loaded cable of many quads and laid directly between Moji and Fuzan, and not *via* Tsushima on the economical point of view. Both of these two Korean Strait cables are almost of the same length extending over 400 km, one of the longest submarine telephone cables in the world.

These quaded toll telephone cables, loading coils, repeaters and submarine cables were all supplied by the foreign manufacturer's in the early course of the extension, but at present all the materials and apparatus required for the construction of long-distance toll telephone cable networks are almost all manufactured by our home companies except a few materials such as the iron dust core and balata insulated cables.

As the auxiliary means of the long distance telephone networks, the carrier current telephone system is prevailing in the countries to a large extent, such as America and Australia. In our country, this system was first applied to the Tokyo-Osaka aerial line to relieve the heavy traffic before the completion of the Tokyo-Okayama cable. Thereafter, the multi-channel system, together with single channel system, was adopted to a large extent, and the channel kilometers are at present estimated to be 6,150.

The no-delay system was adopted for the telephone communication between large cities and their outskirts to offer the same facilities just as in the same exchange area.

Wireless Telegraph and Telephone Business

The first wireless experiment in our country was carried out over a distance of about 2 km in December 1897, and thereafter the system developed by the pioneers fortunately contributed assistance in the Russo-Japanese war. The first commercial stations were inaugurated in May 1908, at Otchishion the coast station and on board s.s. *Tenyo*. The transpacific commercial service was opened in 1915 between Kahuku in Hawaii Island and Funabashi on our side. The status of the wireless telegraph and telephone services at the end of March 1930, is shown in the following tables :

	Wireless Telegraph			*Wireless Telephone*		
	Public	*Government*	*Private*	*Public*	*Government*	*Private*
Fixed stations	36	3	2	—	—	—
Coast Stations	32	3	2	2	—	—
Aviation Stations	3	—	—	3	—	—
Small Stations for Island Communication	25	—	—	—	—	—
Stations for Special Services ..	—	13	20	—	4	16
Compass Stations	—	4	—	—	—	—
Experimental Stations ..	—	41	87	—	24	76
Ship Stations	23	41	1,102	6	17	54
Aeroplane Stations ..	—	—	7	0	0	7
Armature Stations	—	—	61	—	—	41
Broadcasting Stations ..	—	—	2	—	—	9

Note : The station for several purposes is counted as one for each service.

For the safety of navigation, a ship of not less than 2,000 tons (gross) or carrying 50 persons is bound to install a radio telegraph on board. At present over 1,071 vessels are equipped with radio sets.

Coast stations have greatly increased in number due to very complicated coast lines of our country. Among them Otchishi, Choshi and Osezaki are the thrçe most important stations equipped with 3 kw transmitter and operated with duplex system. Meteorological bulletins are broadcast from Tokyo, Kobe, Naha etc., but time signals are transmitted only from Tokyo and Choshi. Press messages are also sent to the enlisted ships from Tokyo. Several beacon and compass stations are still under construction, except a very few stations in the western part of the country.

At present there are seven aviation stations located in the main aerodromes or along the aviation routes. They are engaged in furnishing special meteorological notations and other information for aviation service as well as public messages.

Especially in the case of colonial service, radio acts to save over-flow messages in rush hours and to play a very important rôle in emergency. The stations in Keijo, Dairen, Taihoku, Otomari and Palao, which are equipped with both long and short wave transmitters, are the main big stations. Besides these stations, there are numerous medium and short wave stations as aids to land lines and cables to constitute the emergency radio network in co-operating with some of the coast stations.

As Japan is situated far from Europe and America, direct communication should be carried out efficiently and economically by the aid of wireless telegraphy and telephony. Communication with U.S.A. has been carried out since 1915 by the Funabashi Radio, high power station of the Navy, and later by the Iwaki Radio of the Department since 1919. This Radio is the first high power station and is noted with its unique reinforced concrete tower 200 meters in height, with the Haranomachi station as transmitting and the Tomioka station as receiving. A new station was erected at Fukuoka near Tokyo and the transpacific radio service was centralized at the Tokyo Radio by linking with wire since 1927. Since 1928, direct communication between Tokyo and San Francisco has been carried on and the time required for transmission of message has been shortened by more than 30 minutes.

The Osaka Radio has been used in receiving one way messages from Nauen in Germany, Bordeaux and St. Assise in France and Warsaw in Poland. In April of last year, the Nagoya Radio which is especially intended for European service was opened, adopting the Telefunken system. Its transmitting station at Yosami is the greatest longwave high power station in Japan, with maximum antenna power of about 700 kw. Several more stations for communication with countries, such as China, British India, Dutch Indies, Australia, and the second station for the communication with America, are going to be established in the near future. To promote the transoceanic radio communication "Nippon Musen Denshin Kabushiki Kaisha," *i.e.* Japan Wireless Telegraph Co., Ltd., whose is shared by the Government and the public, is allowed to erect and maintain radio stations for foreign

communication, but the telegraph messages are handled by the Department itself.

With a view to stimulating the healthy and independent progress of the broadcasting service, the Japan broadcasting association, so called "Nippon Hoso Kyokai," was founded in 1926 by the leading of the Government. Prior to its foundation, the temporary 500 watt small broadcasting station was opened in Tokyo in the summer of 1925. At present there are operating the seven 10 kw, stations and one 3 kw. station, having two independent studios in Kyoto and Fukuoka. In this year, five more stations are going to be constructed. Those stations and studios are all connected by means of special telephone lines and radio links in order to carry on the simultaneous broadcasting of important programs. One of the most interesting problems of the broadcasting in our country is how to organize the varieties of musical programs, such as Japanese, Chinese, as well as European classical and popular ones. Another important problem is the geographical features of our country. In co-operating with the Government, the Association has studied the best scheme to cover the whole land with an efficient broadcasting network, and the extension plan of the broadcasting network is going to be carried out according to the financial conditions of the Association. The following table showing the increase of the number of subscribers will serve to indicate the growth of the broadcasting business.

1925	*1926*	*1927*	*1928*	*1929*	*1930*
5,423	258,499	360,282	379,490	562,079	647,145

In the colonies, there are three broadcasting stations at Keijo, Dairen and Taihoku under the independent management and their subscribers are not so many.

It is the first international broadcasting in our country that the addresses of the King of Great Britain and chief delegates at the opening ceremony of the Disarmament Conference in London were broadcast from the Dochester radio station on January 21 and relayed by the Tokyo broadcasting station; thereafter, on February 9, our chief delegate, Ex-Prime Minister Mr. Wakatsuki, delivered an address to our people from the Dochester radio station which relayed by the Yokkaichi radio station with satisfactory results.

11.50 p.m. on October 27, 1930, was world's history-making sublime moment, dashing towards an eternal human ideal, a world of disarmament. Mr. Yuko Hamaguchi, Premier of Japan, first addressed the world's peoples through the microphone on that occasion, speaking in a low, solemn tone. It was followed by an eloquent speech delivered in a quiet energetic voice by President Hoover of the United States, and finally, Mr. Ramsay Macdonald, Premier of Great Britain, made an impressive speech. This international broadcasting was proposed by the American Government; and for its successful relay between Japan and America the Japanese Communications Department took charge, and made use of the Kemigawa Sending Station and the Isatsuki Receiving Station. The results were entirely satisfactory.

The wireless telephone business has made slow progress and is utilized only for communication to some isolated islands and from ships sailing near the harbors of Kobe and Moji. On the other hand, the transoceanic radio telephone service has recently shown extraordinarily rapid progress due to the technical development of the short wave, as shown in the services between New York and the principal towns in Europe, between Berlin and Rio de Janeiro in South America, etc. In July of this year we made a very interesting trial of radio telephone communication between the Department in Tokyo and Baron Shiba in Berlin, one of our delegates to the World Power Conference, with fairly good results, by the short wave in the Tokyo and Nauen Radio; and we believe that the telephone communication service will be certainly realized between Japan and several countries in Europe and America in the near future.

LIST OF AUTOMATIC TELEPHONE EXCHANGES IN JAPAN, IN SERVICE AND IN ORDER UP TO MARCH 31, 1930

Place and Station name	*Subscriber lines*	*Delivered by*	*Switched in*
TOKYO:		A.T.M.	1926/27
Kanda	4,400	,,	,,
Kayabacho	3,600	,,	,,
Kudan	3,900	,,	1927
Otsuka	3,900	A.E.I.	1927
Marunouchi	4,700	,,	,,
Nihonbashi	4,200	,,	,,
Shiba	4,500	,,	,,
Mita	803 for Mita	,,	1929
Asakusa	8,000	,,	1927/29
Akasaka	2,000	,,	Not yet in service
Ginza	5,600	N.D.	,,
Total	68,000		
OSAKA:			
Horikawa	2,000	S.H.	1928
Tennoji	2,500	,,	,,
Fukushima	1,600	,,	,,
Total	6,100		
KYOTO:			
Honkyoku	7,000	A.E.I.	1928
Gion	4,800	,,	,,
Total	11,800		
NAGOYA:			
Honkyoku	5,000	A.E.I.	1928
Naka	4,000		
Total	9,000		
YOKOHAMA:			
Honkyoku	6,000	S.H.	1926
Chojamachi	6,000	,,	,,
Total	12,000		
KOBE:			
Minatogawa	5,000	S.H.	1928
Suma	1,700	,,	,,
Total	6,700		
Nakano	4,800	2,800 N.D. 2,000 Oki D.	1930 not yet in service
Senju	1,400	A.E.I.	,,
Kawasaki	1,800	,,	,,
Ebara	1,600	,,	,,
Sumiyoshi	1,600	S.H.	1928
Tenkachaya	2,300	,,	,,
Ashiya	2,000	S.B.	1930
Mikage	3,600	,,	,,
Total	19,100		
Grand Total	132,700		

(up to March 31, 1930).

(N.D.—Nippon Denki (Standard Electric).

PENANG'S NEW POWER STATION: It has been decided to erect a new power station in Penang, near Northam Road.

EDGAR ALLEN K. B. PULVERIZER: Edgar Allen & Co., Ltd., have issued a new pamphlet describing their K. B. Pulverizer, an all-steel hammer mill of simple design and scientific construction. It is made for fixed and portable plants, and is used for reducing materials to a fine powder, or it can be used for producing chippings suitable for road metal, etc. Numerous tests have been carried out recently on K. B. Pulverizers, which when adjusted to produce $\frac{1}{2}''$ and $\frac{3}{4}''$ chippings, give a product more cubical in form than that produced by granulators or crushing rolls, and containing a low percentage of dust.

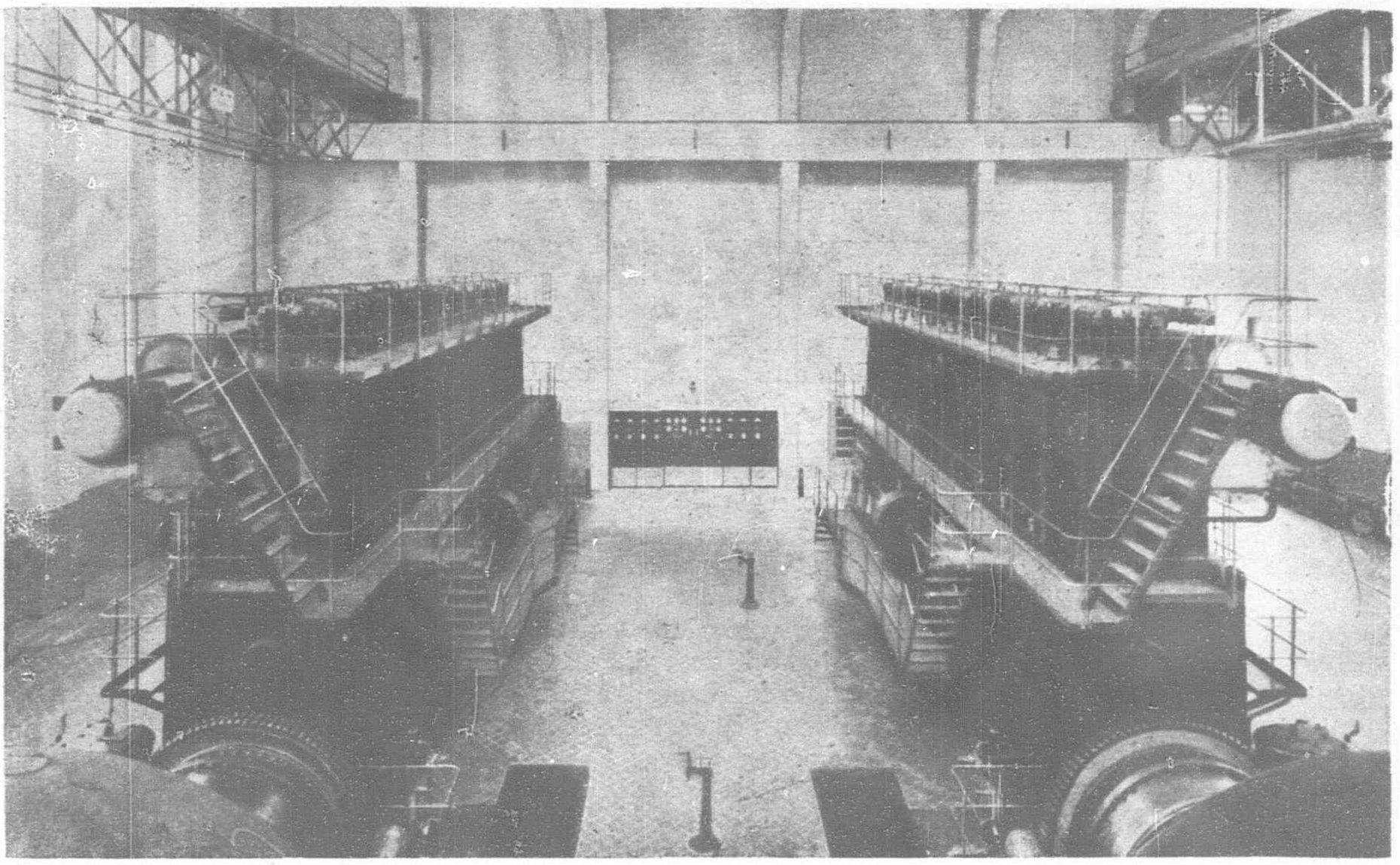
LIST OF AUTOMATIC TELEPHONE EXCHANGES IN JAPAN, IN SERVICE AND IN ORDER UP TO MARCH 31, 1930

Place and Station name	*Subscriber lines*	*Delivered by*	*Switched in*
TOKYO:			
Kyobashi	7,700	A.T.M.	1926/27
Honjo	7,000	,,	,,
Shitaya	8,500	,,	,,

A 15,000 kw Peak-Load Diesel Plant

At a Substation of the Maerkishes Elektrizitaetswerk A.G., Berlin, a Diesel Peak Load Equipment is installed, which is claimed to be the largest of its kind in the world

AT the Hennigsdorf substation of the Maerkisches Elektrizitaetswerk A.G. there have recently been placed in commission two 7,500-kw. diesel-driven generators, intended for peak-load service, and it is stated that this plant constitutes the largest of its kind in the world. In addition



Hennigsdorf Peak-load Station: Two Compressorless Double-acting Two-stroke M.A.M. Diesel Engines 11,700 h.p. each

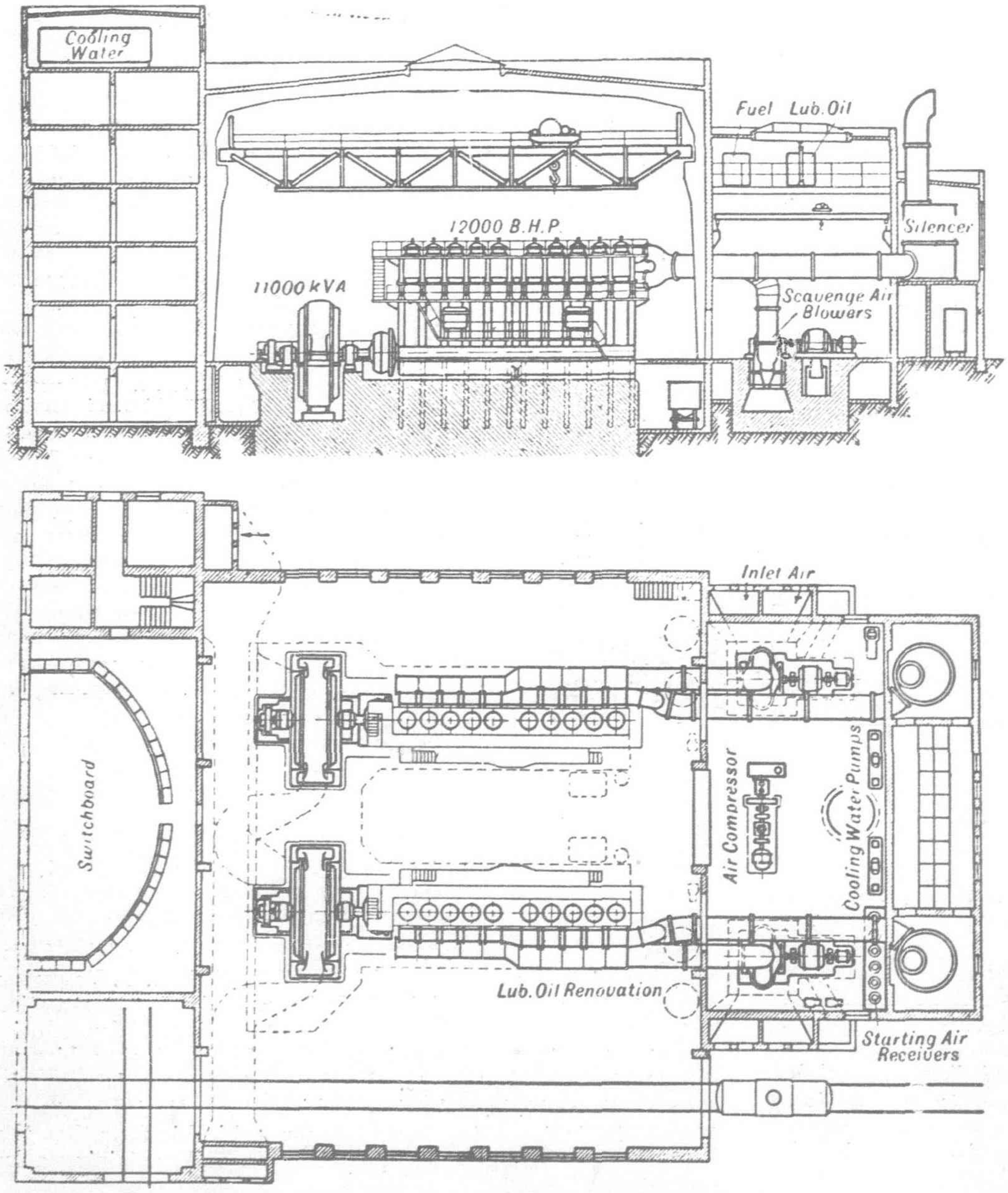


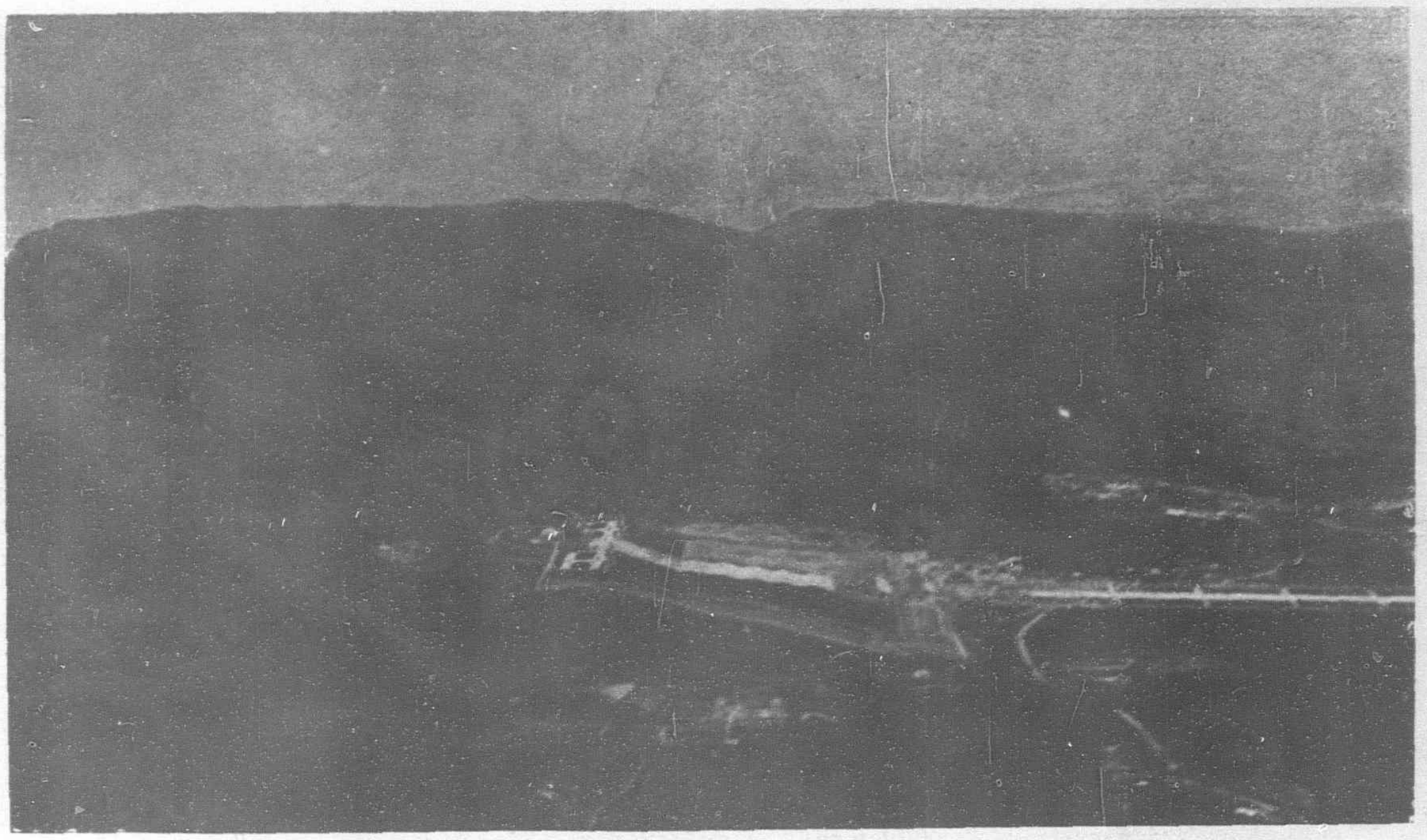
Fig. 1—New Installation at the Hennigsdorf Peak-load Station

the engines themselves incorporate many points of interest. Each set is a double-acting two-stroke cycle airless-injection engine, rated at 11,700 b.h.p. at 215 r.p.m. Deducting the power required for the scavenging blowers the net aggregate output is 14,000 kw. for the two sets.

The design differs from that of the 15,000-b.h.p. set installed in the power station at Hamburg in several important respects. While the unique M.A.N. loop system of scavenging, with super-imposed air and exhaust ports around about 50 per cent of the cylinder liner periphery, remains, the main framing, cylinder covers, jackets and other parts are different. The Berlin engines are of the airless-injection type, whereas the Hamburg machines operate with air blast. The newer design is lighter and simpler. In the earlier construction square upper and lower covers, bolted together to form two continuous girders, were employed, with separate cylindrical cylinder water jackets. Short cylinder frames were introduced between adjacent jackets and were placed directly over each main frame. While the main framing and bedplate are approximately the same in both designs, the newer engine is provided with cylindrical cylinder covers, while the jackets are bolted together to form a continuous girder of great depth. The construction is clearly shown on page 704, which also shows the separate cylindrical cylinder covers now employed. Tension through-bolts pass from the top of the jacket to the lower side of the bedplate at either side of every main bearing.

A single fuel valve is housed in the center of each upper cover, while there are four fuel valves, suitably grouped around the piston rod, in each lower cover. These valves are of the automatic type, the fuel pumps (one per cylinder end) being arranged at the front of the engine in two

(Continued on page 704).



Aerial Photograph of Dr. Sun Yat-sen's Memorial at Nanking

Commercial and Military Aerial Photography

By G. W. BROPHY

THE lofty bird soaring as its will and whim dictates, is no longer envied by man for its precious heritage, the bird's-eye view. A man-made bird has appeared with a mechanical eye that is sharper, more positive and capable of preserving and commercially exploiting what it sees, a welcome contribution to this progressive age.

To-day the commercial possibilities of aerial photography are unlimited, and although a comparatively new art, is fast becoming a great factor in commercial pursuits. New avenues of use are arising daily wherein aerial photography is being called upon and the demand is steadily increasing. Aggressive operators are entering this unusually remunerative field with only a small addition to their present equipment, thereby providing for a year round source of revenue.

There are two major types of aerial photographs—the oblique view, and the vertical view. The oblique view shows the subject matter in perspective, and the vertical view is taken with the axis of the lens perpendicular to the ground. By taking a series of vertical views, it is possible to mosaic these individual pictures into a composite known as a mosaic map. The wealth of information and detail that can be shown in this manner is too numerable to mention. Among the many uses to which oblique pictures are put are : locating of real estate, buildings, acreage, schools ; newspaper requirements ; advertising, etc. Among the uses to which vertical pictures are put are : city planning and zoning ; regional planning ; highway development ; right-of-way location for highways, railways, transmission lines ; sewerage study ; drainage study ; irrigation work ; reservoir location ; flood control and development ; soil analysis ; geological study ; harbor improvements ; timber classifications ; property appraisal ; tax assessment ; terminal sites, traffic control, etc.

Prior to this year the Fairchild Aerial Camera Corporation has concentrated exclusively on the development of aerial photographic equipment for military use. By intensively developing the military aerial photographic field, it gained world-wide reputation for its instruments through their reliability, workmanship and progressive designing through embodied in each and every new instrument introduced. Continuous study and thought obsoleted many of the old ideas regarding aerial cameras and with co-operation with such valuable agencies as the U.S. Army Air Corps Experimental Section at Wright Field and the Royal Canadian Air Force, developed a line of aerial cameras that are to-day pronounced the most progressive and valuable types of cameras exclusively for aerial photographic work in the world.

(See illustrations on next page)

New Pacific-India Service

With the placing on the round-the-world service operated by the Kerr Line from New York of the new Silver Line motorships, *Silverwillow*, *Silveryew*, *Silvercypress*, *Silverwalnut*, *Silverpalm*, *Silverteak*, and *Silversandal*, built or building in Great Britain, the vessels previously engaged are released to establish a new express service from Los Angeles and San Francisco to Rangoon and Calcutta, *via* Manila, Singapore, and Colombo. This service which will afford monthly sailings from the two ports, was inaugurated in June by the sailing from San Francisco of the *Silverhazel*, to be followed by the *Silverguava*, *Silvermaple*, and *Silverbelle*, each of which is equipped with refrigerated space.

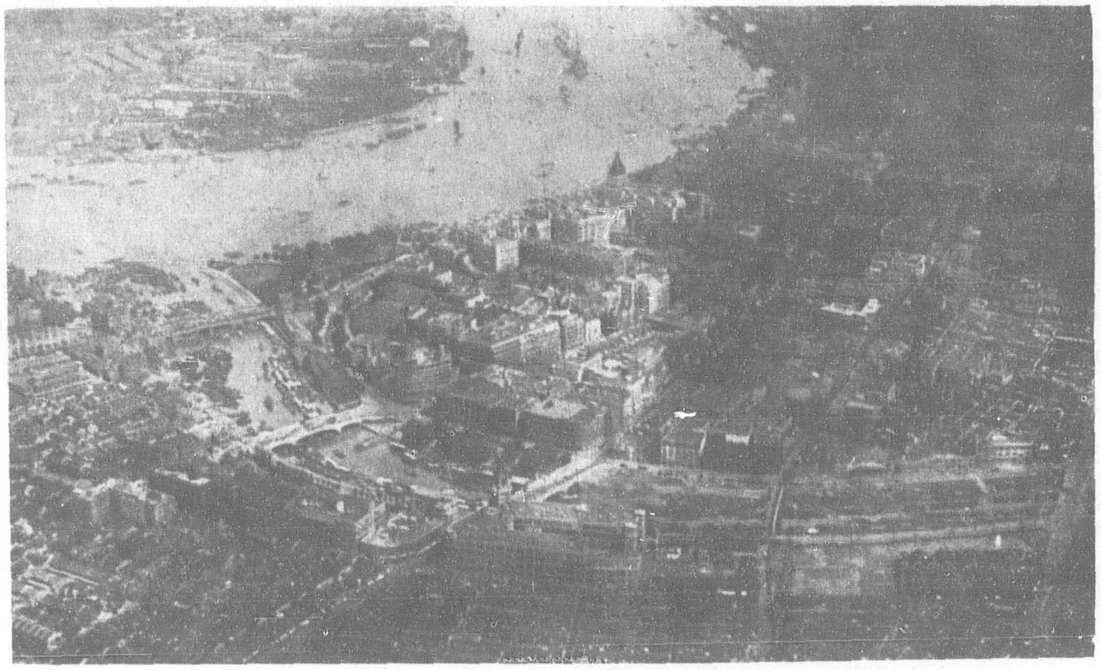
Apart from the furnishing of a rapid general cargo and refrigerator service to the ports of Rangoon and Calcutta, the new express line will reduce the time to Manila from 23 to 20 days, and from Singapore from 30 to 26 days, while Colombo will be reached in 32 instead of 47 days as at present. The time to Rangoon will be 37 days, and to Calcutta 41 days.

The new service is known as the Pacific-Philippine-Straits-India express service. It will not in any way affect the operation of the round-the-world express service or the Pacific-Java-Calcutta service operating between Pacific Coast ports and Dutch East Indies, Straits Settlements, and the East Coast of India.

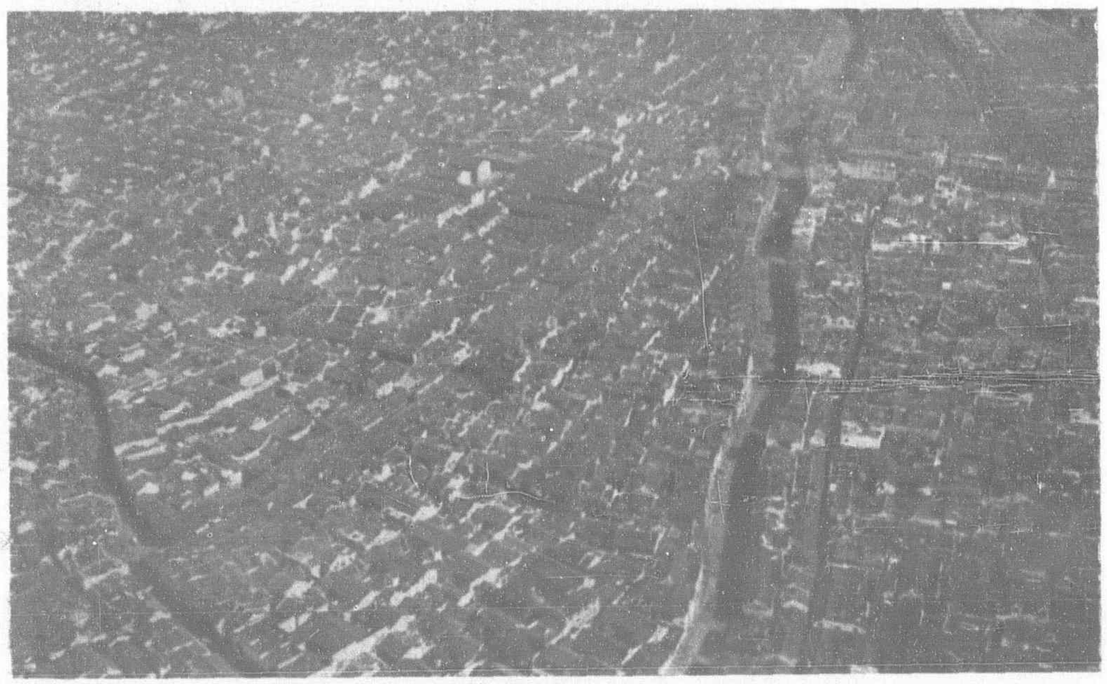
SHANGHAI FROM THE AIR

Remarkable Aerial Photographs taken by the Fairfield Aerial Camera Man

Soochow Creek, Shanghai

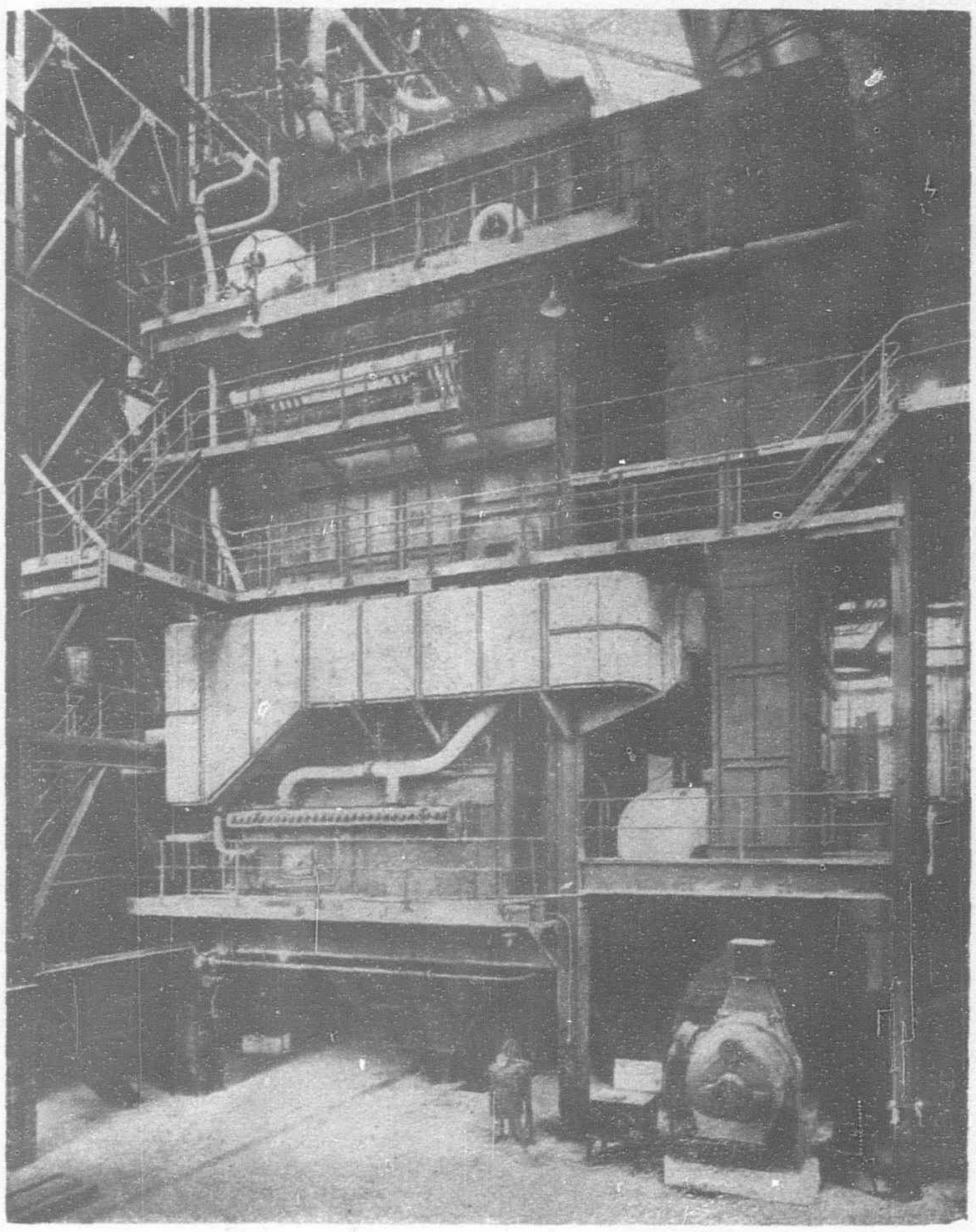


Shanghai: 1,000 feet Above the Heart of the Settlement

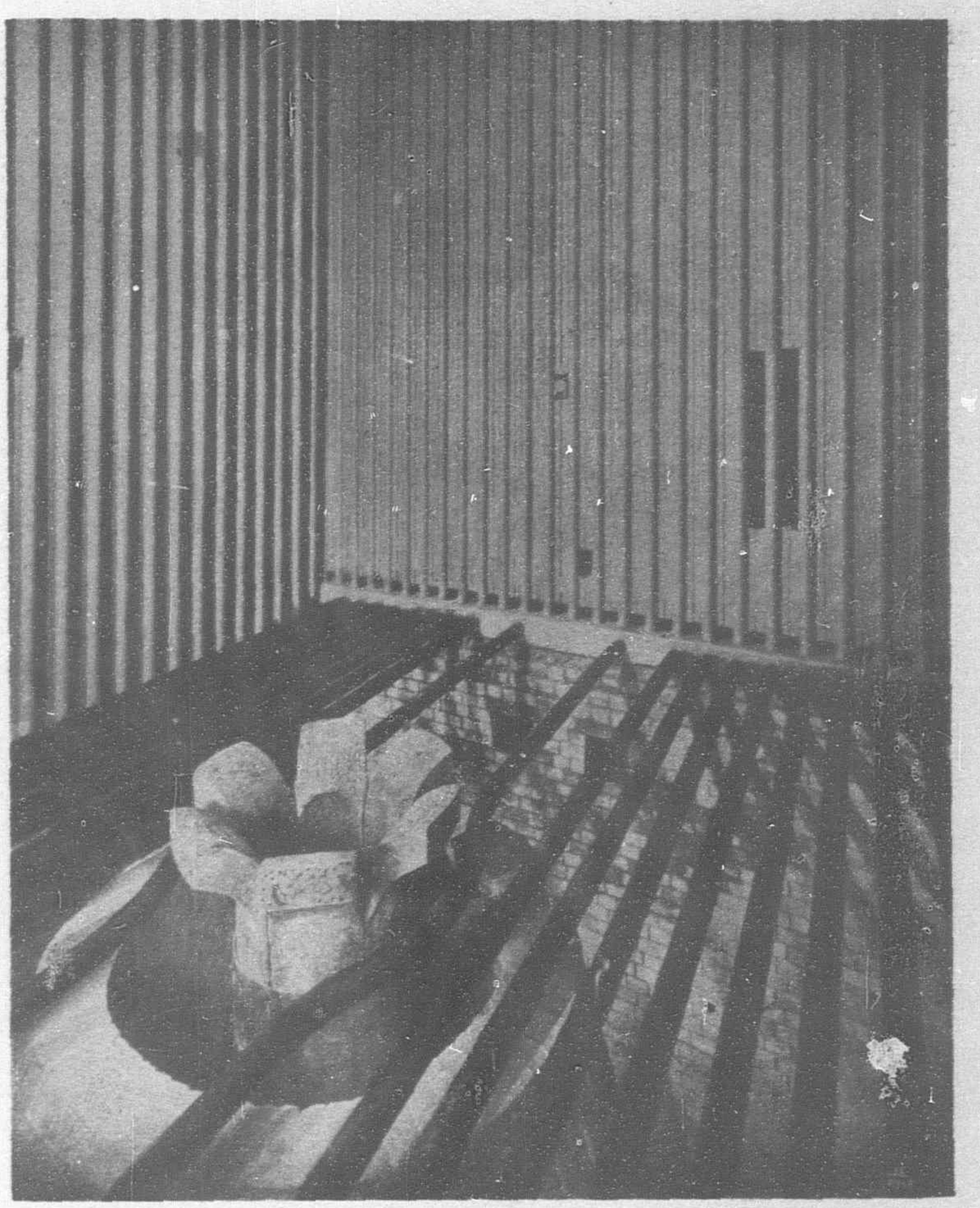


Greater Shanghai: The Chinese City from the Air

The Bund



View of One of the Steam Generators



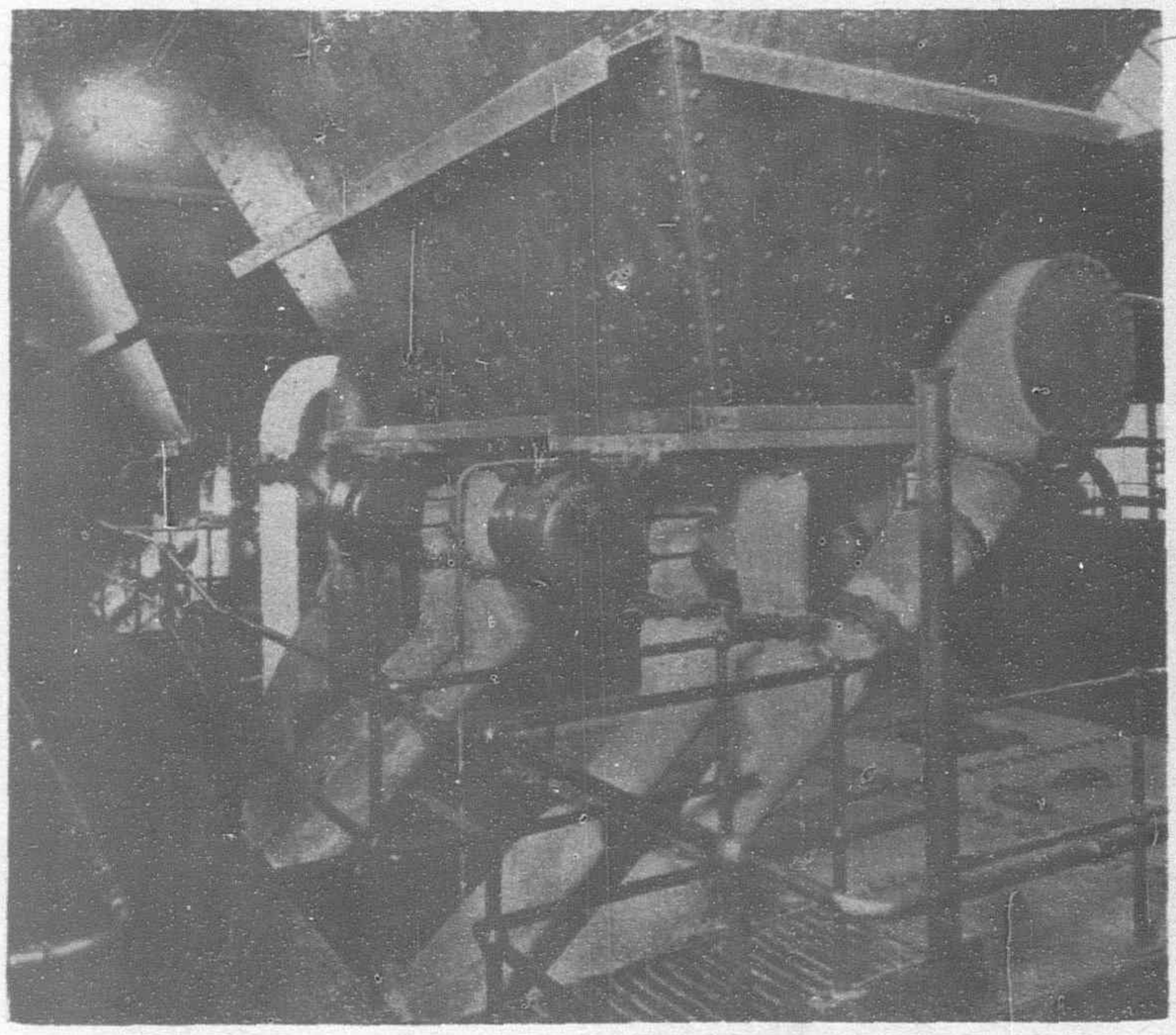
Interior of Steam Generator Combustion Chamber Showing the New "Volcano" Burner

Derby Electricity Station, 1929-30, Extensions

The Latest Principles of Pulverized Fuel Firing

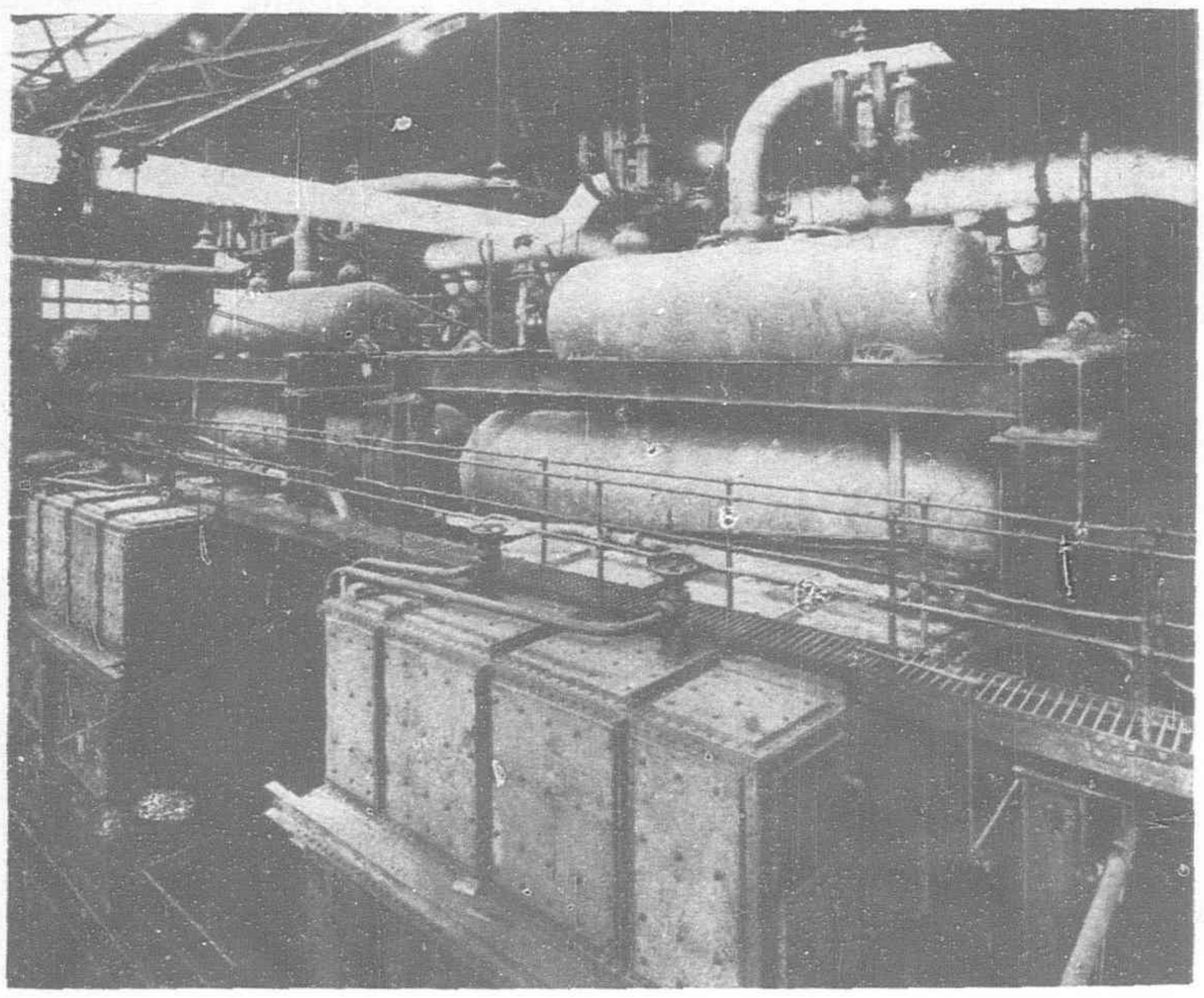
A Notable Installation in Great Britain

OF great interest in the field of electricity is the recent official opening in England of the 1929-1930 extensions of the Derby Electricity Station, especially since the most recent advances in pulverized fuel firing are represented. The new plant consists essentially of two "Combustion Steam Generators," a new design of water tube boiler, each 60,000—80,000 lbs. evaporation per hour, and a "Parsons" 20,000 kw. turbo-generator, with turbines of the single cylinder, pure reaction type, for high efficiency. Firing is carried out with "Lopulco" pulverized fuel equipment, which includes the entirely new "Volcano" burner and the latest "Duplex type of pulverized coal feeder, while also the chimney gases are all washed with pressure water sprays to remove fine dust. Pulverized fuel firing according to the "Lopulco" system was first adopted at Derby in 1924 on two "B and W" boilers, while a third "B and W" boiler was installed in 1928, the results being excellent, but the present 1929-1930 extensions, constitute a further notable advance. The new boilers have been designed and constructed by Combustion Steam Generators Ltd. and consist of a steam and water drum with four complete combustion chamber walls of "Murray" fin water-cooled steel tubes in series with the boiler. Also the roof of the combustion chamber is formed of horizontal boiler tubes with the water screen below the "M.L.S." superheaters, "Usco" multiple plate air heaters and "Foster" steel tube economizers with cast iron fins are included, the pressure being 360 lbs. and the temperature 750°F. The new "Volcano" burner, of which only one is required per boiler, burning up to five tons per hour, is a somewhat modified "R" turbulent burner, but fixed in the bottom of the combustion chamber pointing vertically upwards, projecting through the water screen tubes, some of which are diverted for the purpose, the flames therefore spouting upwards. Also the outer casing of the volcano burner is a large firebrick cone, and as with the "R" burner

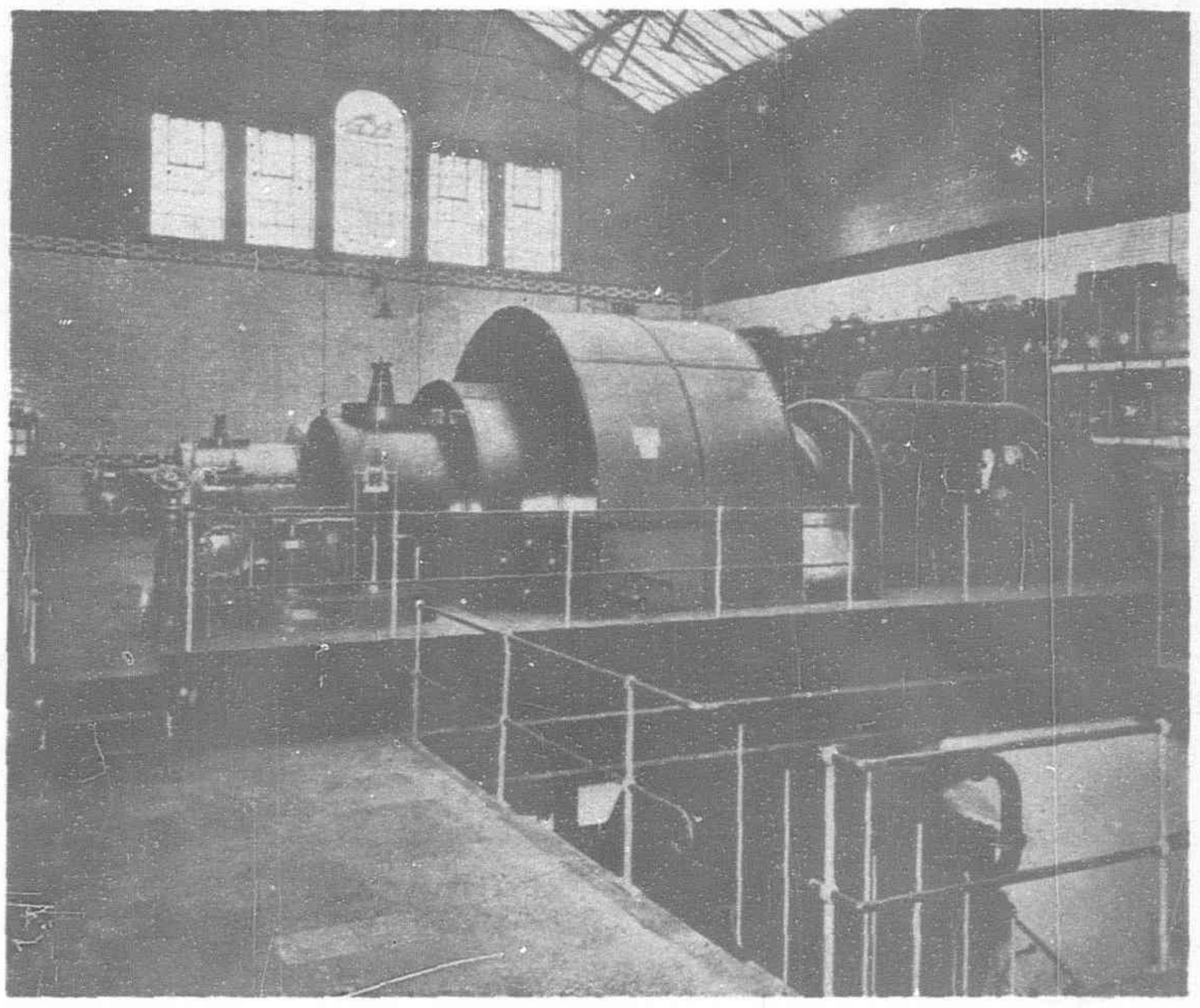


Derby Electricity Station: Pulverized Fuel Bunkers and Duplex Type R Feeders

there is both primary air carrying the pulverized coal and secondary air passed to the burner, each of which is given a turbulent motion by helical vanes. Further to increase the mixing action in the combustion chamber, part of the secondary air is now projected from the lower part of the steel tube walls as a series of jets, while no brickwork is used for the boiler setting, which is entirely of steel plate. Also an additional 6-ton per hour "Raymond" pulverizer has been installed, and at the present time Derby has five boilers of 60,000—80,000 lbs. per hour evaporation, two vertical rabble arm coal driers of the "Rosencrantz" design, and three "Raymond" mills of six tons per hour. For feeding the pulverized coal to the burner, two "Duplex" feeders are used, consisting of two horizontal perforated plates with a rotary scraper between, replacing the screw feeders. The washing of all the combustion gases with water sprays to remove grit takes place near the base of the chimney, and Derby therefore, burning also cheap low-grade coal, is another striking example of the fact that a smaller station or industrial power plant may be equipped on the most scientific lines and give results, equal to the gigantic super power station.



View of Upper Part of Two Steam Generators



View of 20,000 kw. Set Installed, 1929

Derby Electricity Station, 1929-30, Extensions

Oil Engine Driven Emergency Sets

MESSRS. Petters of Yeovil have recently supplied two 30 kw. 220 volt emergency sets, installed in the "Cementkarrier" a Diesel-electric ship built by the Furness Shipbuilding Co., Ltd. for the Canada Cement Transport Co., Ltd., of Montreal. These sets consist of Petter twin cylinder 50 hp. Atomic Diesel Engines with direct drive to compound-wound G. E. C. Witton generators and it has been arranged that these plants may also be run in parallel with 50 kw. auxiliary generators.

These engines operate on the two-stroke-cycle, by which there is a power impulse imparted to the crankshaft once every revolution per cylinder, as against a corresponding impulse once in two revolutions obtained in the four-stroke cycle type.

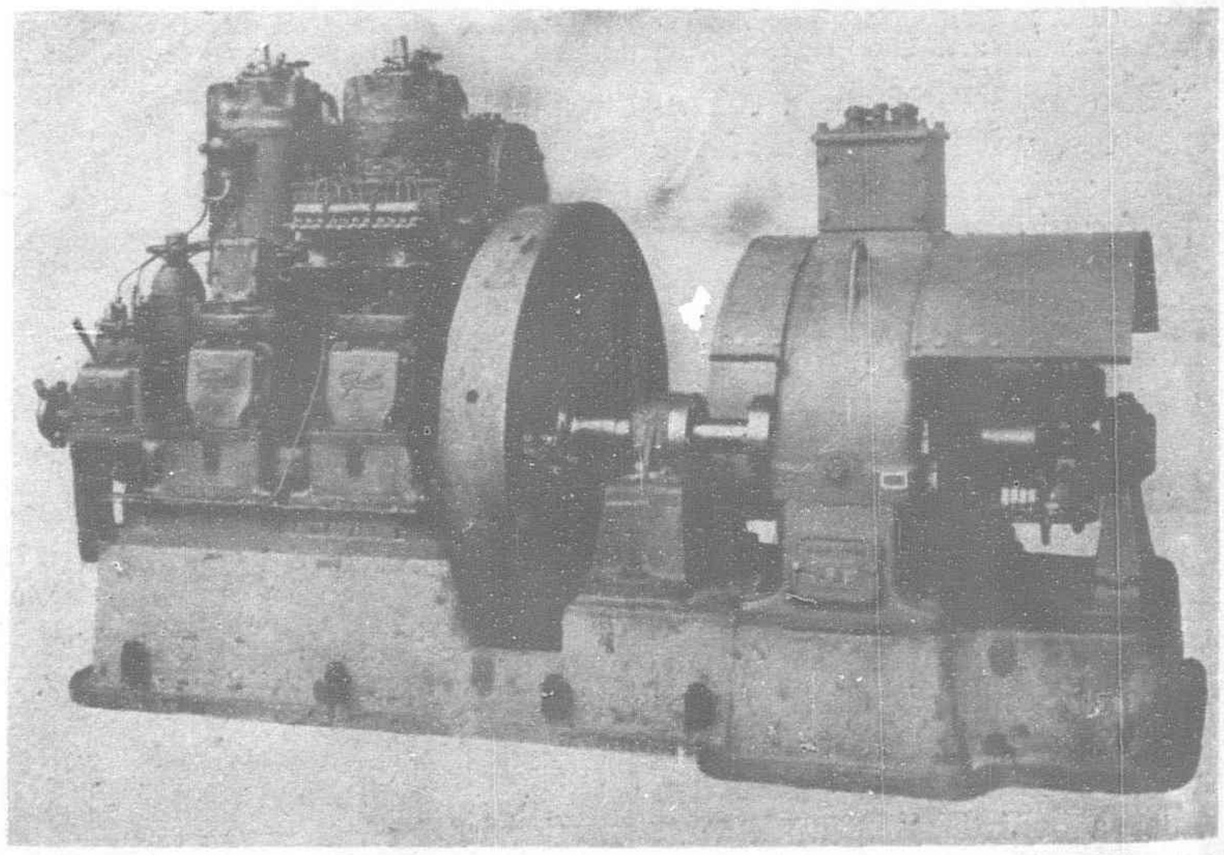
This important result is accomplished by arranging that the piston shall uncover two separate series of ports placed in the cylinder when nearing the end of its power stroke, thus permitting first the escape of the combustion products to exhaust, followed by a scavenge of fresh air through separate ports uncovered after the pressure in the cylinder has fallen sufficiently. On the return of the piston this scavenge air charge is compressed to such a temperature that ignition occurs while the atomized oil fuel is injected near the top of the stroke. Rise of pressure takes place and continues during a small portion of the power stroke, thereafter expansion of the highly heated gases follows—doing work up on the piston until the reopening of the cylinder ports.

It will be at once seen that all mechanically operated valves on the cylinder head—inseparable from the four-stroke cycle—are eliminated together with all valve gear and an extremely simple and reliable engine results.

These engines normally start up readily on all grades of fuel oil complying with the B.E.S.A. specification, but owing to the fact that under special climatic conditions of service in the case of these particular plants they may have to start up at a moment's notice at temperatures 30 degs. below zero—a small daily service tank independent of the main fuel supply has been fitted which is furnished with gas oil for ease in starting up. After a few minutes operation this supply is cut off from the engine which is then switched on to the main supply oil tanks.

The governing of these Engines forms one of their outstanding features.

The experience obtained with these plants has shown that under all conditions of load from 3 kilowatt to 30 kilowatt, and with severe fluctuations occurring continuously, the voltage is maintained as steady as a rock—without suspicion of a variation in the light. Outputs up to 40 kilowatts have been momentarily obtained from these plants, without apparent distress on the part of the Engine.



50 b.h.p. Twin-Cylinder Petter Atomic Diesel Engine Direct Coupled to 30 k.w. G.E.C. Witton Generator. Emergency Plant (One of Two) on Canadian Vessel "Cementkarrier"

Green Island Cement Company's New Plant

THE Green Island Cement Company is in the process of modernizing their works by installing up-to-date cement making machinery in place of their existing plant, which has served them so well in the past. The company has manufactured Portland cement in Hongkong since before the beginning of the present century. Until 1905, shaft kilns were used for burning, but at that date, dry process rotary kilns were installed, and they have been operating ever since.

Since the dry process rotaries were put into commission, improvements in cement manufacture have taken place, chiefly in the direction of more economical methods, and particularly is this so during the last few years. The new works have been carefully thought out with a view to reducing production costs to a minimum, while at the same time maintaining, or even improving, the quality and uniformity of the cement.

One of the latest developments in cement manufacture has been the introduction of rapid-hardening. Portland cement. Such a cement gains its strength much more rapidly, while retaining all the usual characteristics of a good ordinary variety of Portland cement, such as normal setting time, lack of expansive properties, ease of working and the like.

Forms and shutterings can be removed in a day or two, instead of as with ordinary cement ; roads can be used in 48 hours or less when made of rapid-hardening cement. Many excellent uses for such a cement are immediately evident to the concrete engineer.

Gains Strength

In addition to this, the cement continues to gain strength over the years, as is the case with ordinary Portland cement. Such a cement has been known since the war, and in fact, an excellent brand was made in Switzerland during the war. It is only of quite recent years, however, that its exceptional merits have been fully appreciated by British engineers, and now, nearly all cement manufacturers produce an appreciable proportion. Owing to the greater refinements in manufacture, it is somewhat more expensive, but in spite of this, engineers find its rapid-hardening properties of such advantage that the question of increased cost is overruled.

The Green Island Cement Company will continue to make its " Emerald Brand " normal Portland cement, but in addition, the company is making arrangements to produce " Emeralcrete," a rapid-hardening cement of quality, at least equal to that of any other of the best makers. The new works can manufacture about 100,000 tons of ordinary Portland cement a year, and in addition, about 10,000 to 15,000 tons of " Emeralcrete."

The present old works will continue to produce an additional 50,000 tons per annum, until this is gradually replaced by the addition of further new machinery, when the cost of production will be still more reduced.

The company's new output will therefore be some 150,000 tons of first quality ordinary Portland cement, and an additional 10,000 to 150,000 tons of " Emeralcrete " for special purposes. The works have been designed in such a way that without difficulty it can be extended to an output of 200,000 or even 250,000 tons a year of ordinary Portland cement, and a proportion of " Emeralcrete " in addition.

All-British Plant

The new machinery has been designed in accordance with the latest and most up-to-date cement making practice at a cost of £350,000. The plant contains some interesting features and is entirely British throughout. The bulk of the actual cement making machinery was manufactured by Vickers-Armstrongs, Ltd., of Barrow-in-Furness, while the electrical gear and motors were made by Metropolitan-Vickers, Ltd., of Trafford Park, Manchester.

Very briefly, the plant consists of two units, comprising two rotary kilns each 254 feet long and the ancillary grinding, mixing and conveying machinery. The raw mills are 40 feet long by 6 feet 6 inch in diameter, while the cement mills are 36 feet long by 6 feet 6 inch in diameter. The kilns are of exceptional interest in that special cooling arrangements for the outgoing clinker have been arranged. Also, the heat contained in the air which has been used in cooling the clinker is used again for coal drying in the air-swept coal grinding plant.

Special precautions against the wasteful loss of dust have been taken throughout the works. In every department where dust is likely to be generated, dust collecting apparatus has been provided. Furthermore, the gases from the kilns, which always contain a certain proportion of dust which would otherwise be dissipated into the atmosphere, are passed through a Lodge-Cotterell electrical dust preciptation plant, which desposits more than 95 per cent of the dust contained in these gases.

Everything Up-to-Date

Limestone is handled to the primary crushing plant by a Ruston-Bucyrus digger working upon a caterpiller track and feeding fiveton limest one waggons. Clay is reclaimed by means of a Priestman locomotive crane and grab, from the clay barges alongside the wharf, direct to the clay washmills or clay storage heap. Coal is handled in the coal store by means of a Morris overhead traveling crane.

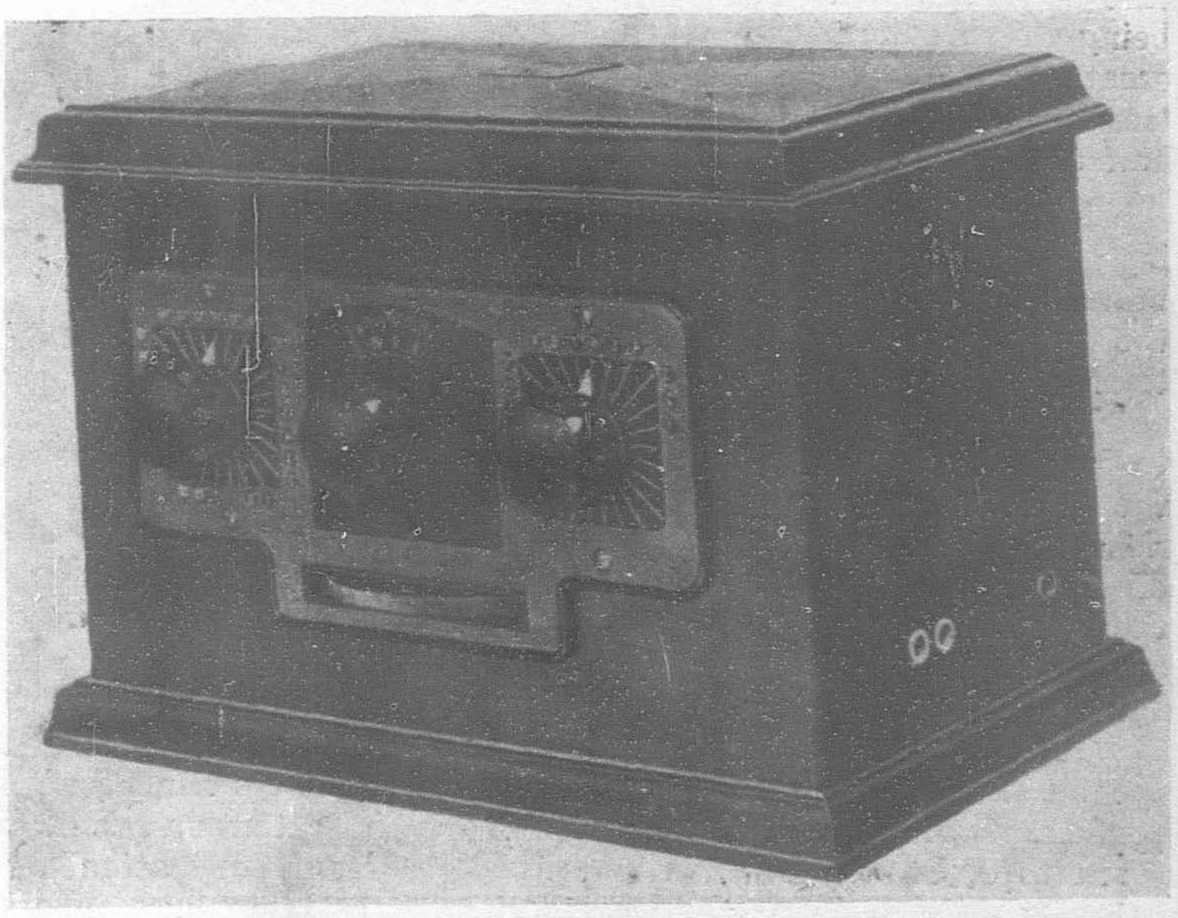
Throughout the works, the most accurate methods have been employed for properly proportioning the raw materials, while the slurry is automatically agitated by means of compressed air. There are eight reinforced concrete cement silos, for holding the finished cement. Seven of them have a capacity of over 2,000 tons of cement each, while the eighth is divided so as contain smaller parcels of cement for special purposes or for special customers.

The erection of the new plant is now proceeding rapidly, and fast work was done in connexion with the erection of the two kilns. The first kiln, without the recuperator section, took 17 working days to erect while the second one took only 11 days.

The work of erecting the plant is being undertaken by the company themselves under the supervision of Mr. Henry Pooley, jr., B.SC., and Messrs. Vickers-Armstrongs, Ltd., and it is confidently expected that the plant will be in operation by the middle of next year.

Mr. Everyman's Short-Wave Receiver

BROADCAST reception across continents and oceans and the possibility of listening to the home-country when thousands of miles away,—these have been achieved by the short-waves. Every important country has its world broadcaster with which it transmits its national program over the whole surface of the globe and in addition over 27,000 amateur short-wave transmitters have been registered.



Telefunken Short Wave Receiver

Up to present short-wave reception, however, was a somewhat difficult affair. There was no question of its being anything like as simple as the reception of broadcast on long-waves. Only the experienced amateur who thoroughly knew the peculiarities of his set, could hope to operate his set. He was the only one who could pick up a definite station by means of clever manipulation of the reaction and aerial coupling, by balancing the tuning

elements, by changing the coils and by the trick of holding his hand near or far from the set, etc. In the most minute section of the scale were about a dozen stations which did not exactly interfere with one another but which owing to the rough tuning devices could only be separated by a regular conjuring act.

Thus an old problem has been solved with the entirely novel constructed "Telefunken 32" now on the market which enables every inexperienced amateur to take part in the interesting reception of distant transmitters, for the operation of this new short-wave set is as easy as that of an ordinary broadcast receiver. The complete wave-band is divided into 60 parts by means of a novel five fold wave switch together with a group selector, and each of these sixty parts can be tuned over a scale of 360 degrees. This stretching of the scale renders the selection of the different stations a comparatively simple matter.

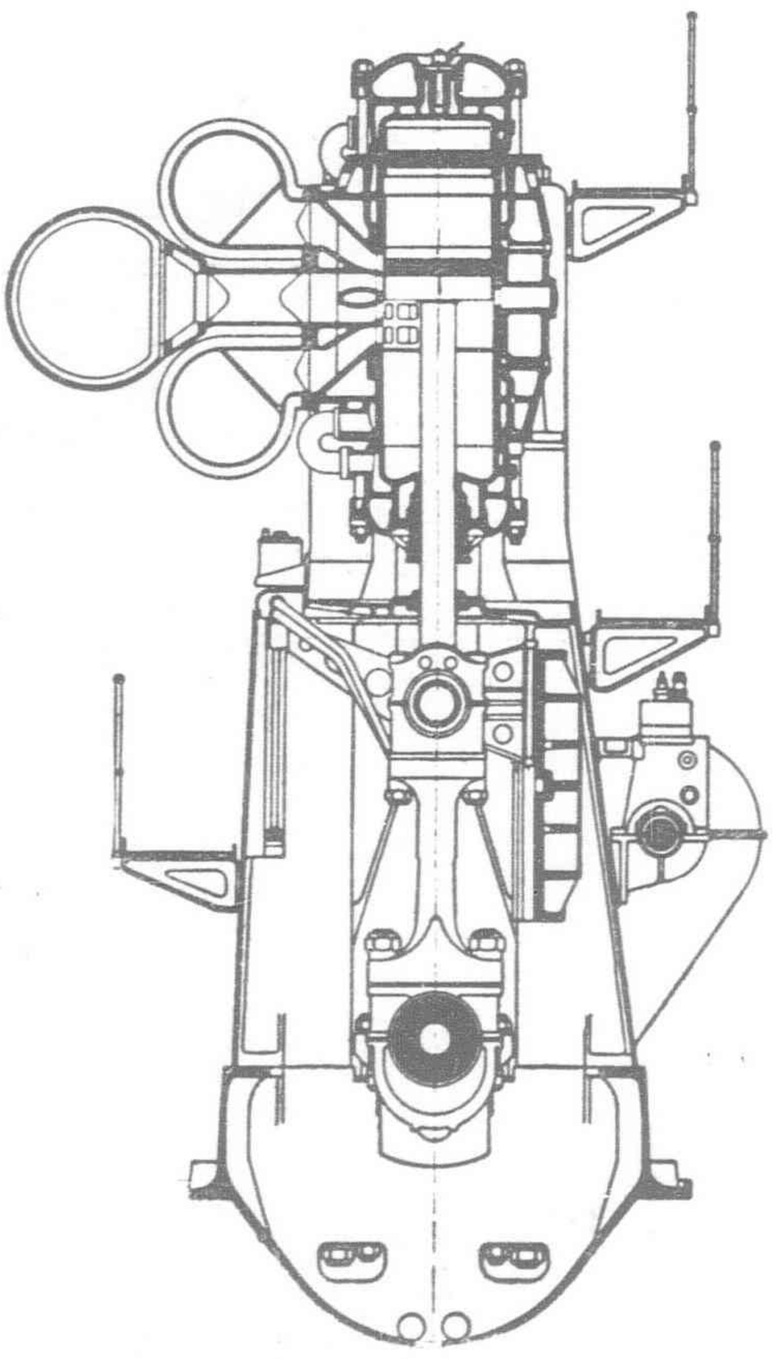
The set is graduated so that any station once found can be tuned in later on the particular line on the scale. Thus the owner of this set—naturally according to local conditions—can tune in such places as Sidney, San Francisco, Cape Town, etc. with the same ease with which he used to hear his local Broadcasting station.

The amateur can hardly imagine how interesting experiments are when he has, by means of wireless, "The whole world in his ears."

A 15,000 Kw Peak-Load Diesel Plant

(Continued from page 698).

groups, as shown in Fig. 2. Fig. 1 is a section through the cylinder, from which it will be noted that the liner joint is below the level of the ports. The engine is so designed that the lower half of the liner can be withdrawn downwards and then sideways on a small wheeled trolley, the clearance between the bottom of the jacket and the crank-case diaphragm plate being somewhat greater than the length of the lower half of the liner.



Sectional Elevation Through Cylinder of M.A.N. Engine

The piston cooling gear is carried on brackets attached to the crossheads, the telescopic pipes being carried well away from the center of the engine where the risk of lubricating oil being carried up the pipes into the cooling water is minimized.

Friction clutches are employed between the engines and the alternators, so that the latter can be used as synchronous condensers with the engines standing. Special attention has been given to emergency starting, the services of only one attendant being necessary. All the auxiliaries—turbo-blowers, cooling-water pumps and lubricating pumps—are motor driven and can be switched direct on to their respective main generators, which are arranged to be initially excited from a battery of accumulators. The engines are, of course, started by compressed air in emergency, but in the ordinary way may also be started by running the alternators as motors off the three-phase system. In Fig. 3 the controls can be seen grouped on a switchboard in the background; each set is controlled by a single handwheel when starting hurriedly, and, further, both sets can be simultaneously started by the single central handwheel.

These emergency arrangements have already proved their value.....For ordinary peak-load service the auxiliaries are, of course, started in the usual way off the available supply, but the plant is quite independent of that service for emergency operation. The excitation battery also supplies emergency lighting.....

These engines have been designed and constructed by the Maschinenfabrik Augsburg-Nurnberg A.G. (the M.A.N. Company), whose agents in Great Britain are John Le Boutillier, Ltd., 13, Rood Lane, London, E.C.3, to whom we are indebted for the data given in this article. We are also informed that it is proposed to arrange an excursion to inspect this plant, in connection with the Second World Power Conference to be held in Berlin in June next.

A Fable with a Moral

How the Ass got its Reputation

At the beginning of things, when the world was young, the donkey was esteemed by all the tribes of men as the wisest of animals.

The good Sheik El-Sta-Shun Air owned a great herd of these sagacious beasts, which was the pride and joy of his life.

Other Sheiks came from all around to listen and marvel at the wisdom of the herd. At such a time came even the Prophet himself—most learned and wise of all the sons of the East. With such glowing pride El-Sta-Shun-Air led him out to the herd, and said: "Behold, O Prophet, the wise and talented asses. Converse with them, test them, and see if they are not verily wiser than 40 trees full of owls."

Then the Prophet addresses the asses. "Let us test your wisdom," said he, "answer me this question: What should an ass require for a three days' journey?"

And they counselled among themselves and then made reply: "For a three days' journey, O Prophet, any ass should require six bundles of hay and three bags of dates."

"Very good," quoth the Prophet, "that soundeth like a fair and proper price." Whereupon El-Sta-Shun-Air broke into loud chuckles and said: "Did I not tell you they are passing wise?"

The Prophet answered, "Wait," and he again addressed the asses. "I have to make a three days' journey, but I will not give you six bundles of hay and three bags of dates for making it. Let him who will go for less, stand forth."

And behold, they all stood forth and began to talk at once. One would go for six bundles of hay and one bag of dates, until finally one especially long-eared ass agreed to go for one bundle of hay.

Then spoke the Prophet: "Fool," quoth he, "you cannot even live for three days on one bundle of hay, much less profit from the journey."

"True," replied the long-eared one, "but I wanted the order."

And from that far-off day to this, asses have been known as fools, and price-cutters have been known as asses.

Lloyd Triestino's New de Luxe Motor Express Liner

The new 24,000 ton motor vessel *Victoria* for the Lloyd Triestino has been successfully launched in Trieste from the San Marco Dockyard. The launching ceremony was presided over by Countess Ciano, the wife of the Italian Minister of Communications, who himself was the guest of honor on the occasion.

The appearance of the ship, characterized by the slanting bow and the cruiser stern, presents a compact and sturdy impression. When completed, the vessel will be the finest example of marine engineering and decorative artistry.

She is being built for the Express De-Luxe Line Trieste-Alexandria, and as she will develop a speed of about 21 knots, the trip will be performed in only 60 hours. She will sail on her maiden voyage in June next.

The accommodation on board is calculated for about 250 first and second class and about 100 second economic class passengers. The ship is being also engined in Trieste, and the propelling machinery is of the Sulzer system. The installation comprises four sets of eight cylinder engines. The total brake horse power developed is 17,000 at 134 rotation per minute.

The power for the auxiliaries in the ship is supplied by four electric generators, each having an output of 534 kw. These will be Diesel-driven by six cylinder Sulzer motors running at 180 revolutions per minute.

Launch of the "President Hoover"

The First of the New Dollar Liners

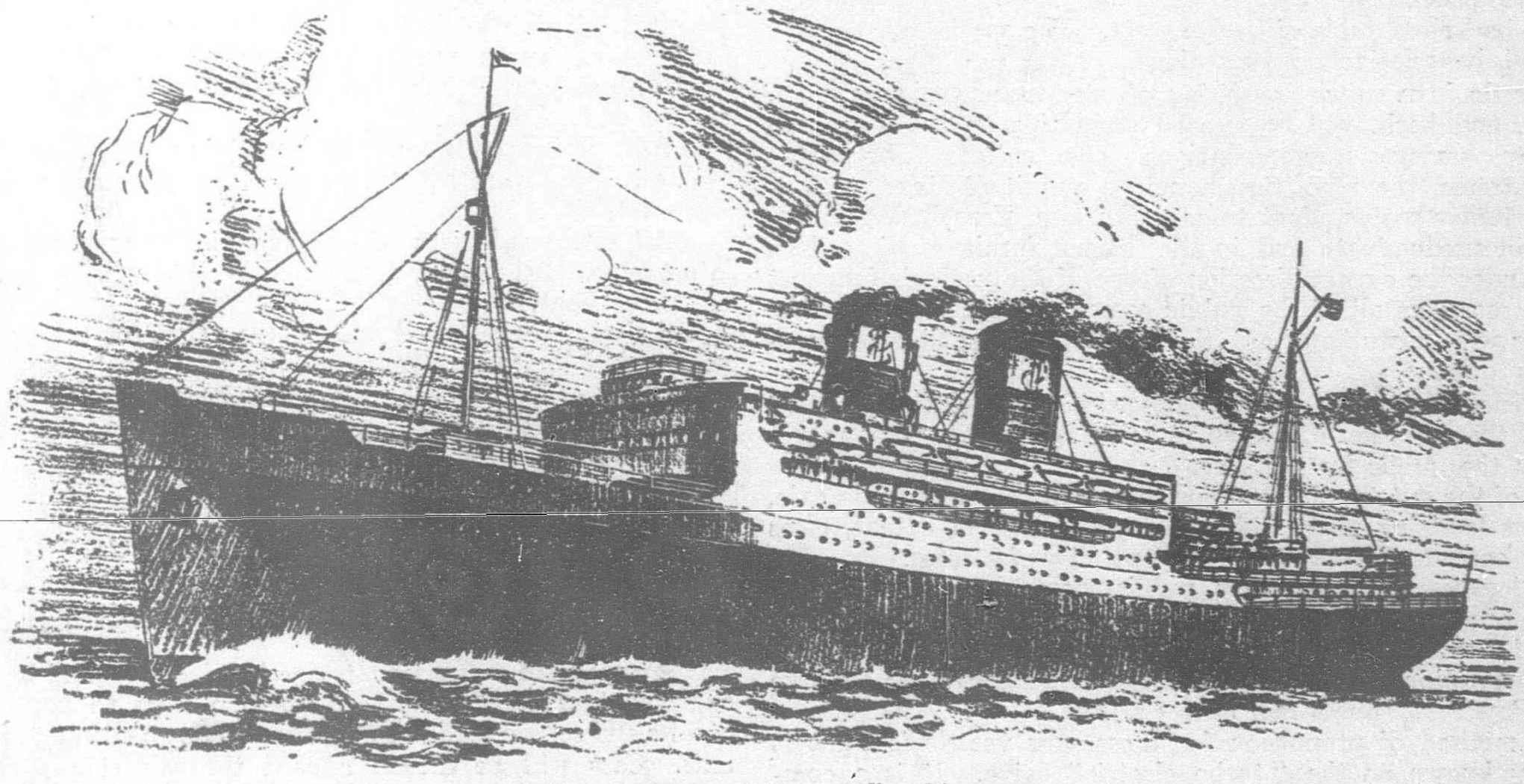
With a bottle of waters collected from the Seven Seas, Mrs. Herbert Hoover, wife of the nation's chief executive, christened the President Hoover, first of the Dollar Steamship Lines' two new $8,000,000 turbo-electric liners, in a colorful ceremony at Newport News, Virginia, December 9.

These two ships, to be the largest, most modern, and palatial merchant marine vessels ever turned out in American yards are the forerunners of a fleet of four queens of the sea contemplated in the Dollar Steamship Lines' building program. They will be the last word in American ship construction planned with the idea of providing the maximum luxury, comfort, speed and safety.

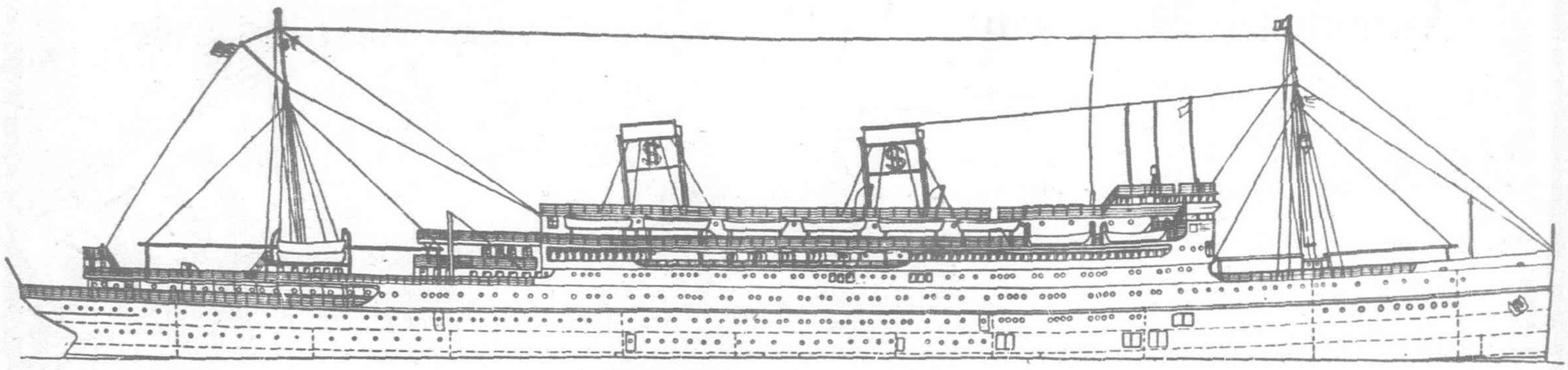
The *President Hoover* will go into service at New York in June, 1931, in a route comprising California, Honolulu, Japan, China, Manila, returning over the same route. The launching date of the second ship, her name and route will be announced later.

For months past captains of the Dollar Round-the-World liners have been collecting a portion of water from the seas traversed on their voyage. To-day the waters are complete with a sample from the Atlantic, Pacific, China Sea, Indian Ocean, Arabian Sea, Red Sea, and Mediterranean Sea, and await release by the hand of the first lady of the land to splash against the prow of the *President Hoover* when the largest American built merchant marine vessel speeds down the ways of the Newport News Shipbuilding Company next month.

Since time immemorial ships have been christened with flagons of wine and bottles of crystal water but a happy thought of R. Stanley Dollar gives to the *President Hoover* the distinction of a new ship starting on its launching voyage under the caress of sea



Artist's Drawing of New Dollar Liners



Outboard Profile of New Dollar Liners

waters of many climes, diverse longitudes and far-spaced latitudes.

To Mrs. Herbert Hoover goes the honor of being the first President's wife in national history to sponsor a ship named after her husband.

The new Dollar liners will be steel twin-screw vessels, nine decks, with slight raked stem and semi-cruiser stern and with two stacks and masts. Their length will be 653 feet, depth 52 feet, beam 81 feet, displacement tonnage 31,000, gross tonnage 23,000, and deadweight 15,800, with 67,000 cubic feet of refrigerated cargo space.

They will have a total passenger capacity all classes of 1,260 and accommodations for a crew of 300. The sea speed of the new ships will be 21 knots.

A de luxe hotel at sea adequately describes the new ships, equipped with elevators, swimming pools, sand beach, gymnasium, children's playroom, soda fountain, veranda cafe, smoking rooms, library, private dining rooms, tea rooms, music and dance salons, talking picture theater, shopping lobby, broadcasting system, stock exchange rooms, writing rooms, beauty parlor, automobile garage, telephones in every room, and any other convenience to be found in a leading metropolitan hotel. The heating and cooling systems serving the ships will be of the most modern construction, capable of providing a given temperature to an exact degree.

The new ships will have rooms for 320 first class passengers and 140 special class, the balance of the total passenger carrying space of 1,260 being devoted to other classes. The staterooms are spacious, well-lighted and with perfect ventilation and heating facilities.

The main dining salon will accommodate the entire first class passenger list at one sitting. Tables seating two, four, six and eight persons will be set about the commodious room. The Captain's table is designed to seat sixteen and as a novel feature there will be a bachelors' table of twelve seats. The special class dining salon will be relatively commodious.

Four de luxe suites consisting of sea veranda, living room, bedroom, and bath, will be located amidships on the first deck devoted to passenger accommodations. These suites will be artistic in the extreme, the tapestries, hangings and furnishings surpassing any similar rooms afloat to-day. In two, French period furniture will predominate and in the others, furniture of modern style. Under the expert direction of one of the nation's foremost interior decorators all of the public rooms and staterooms of the new ships will be works of art, the furnishings and fittings representing a fortune.

The special class accommodations will be a revelation to ocean travelers, that division of the ships being far superior to any yet offered to the public by any line.

One of the outstanding public rooms will be the veranda cafe, a spacious lounging place, thirty by eighty feet in extent, glass enclosed, cool, and providing excellent view facilities.

Spaciousness in promenades, public rooms, lobbies and staterooms of the new vessels is the aim of the builders. Hard-wood walls and floors will distinguish the ships, mirrors and bright, artistic decoration will soften ship atmosphere and make the two latest "President" liners real homes afloat.

The method of propulsion for these new vessels is what is commonly known as the "turbo electric" drive. It is a combination of the principal characteristics of the common steam turbine drive and the more modern method of driving a vessel with large synchronous alternating current electric motors.

The main propelling machinery consists of the following: two latest type marine steam turbines; two alternating current generators, directly connected to the turbines; two main propulsion motors of the synchronous induction type; one control apparatus for the above, which consists of a main operating panel complete with switches, circuit controls, and other necessary equipment; two direct current motor driven exhaust fans, for ventilating the main propelling motors.

The method of operation is traced thus. Steam is generated in the boiler rooms, as on any steam driven vessel, and carried to the steam turbines. These turbines operate the two main generators, which in turn furnish power for the main propelling units. The whole system is controlled from the main operating panel and the speed of the main engines is controlled through the steam turbines.

The principal items of auxiliary machinery are: cargo winches, refrigeration machines, ventilating system, heating apparatus, cooking equipment.

The cargo winches on these vessels will be electrically operated, and absolutely noiseless. They are designed for high speed loading and unloading.

Refrigeration machinery will consist of the latest type machines of both the cooled air process and the brine system, and will be able to hold temperatures as low as five degrees without variation. Special compartments for the exclusive carrying of vegetables are also fitted.

Ventilation will be of the mechanical type. Fresh air will be forced into all rooms and passageways by means of electrically operated ventilating fans, leaving nothing to natural draft, and which will assure all living quarters of an ample supply of pure fresh air. This will be taken into the system from vents on the boat deck. These mechanical ventilators will be thermo-controlled, which will guarantee a continual, steady temperature at a comfortable degree.

All public spaces, such as the dining room, smoking room, etc., will be heated by steam, and all staterooms will be heated by electricity.

All kitchen devices will be electrically operated and of the latest type. All ranges, ovens, and broilers will be equipped with electrical heat.

A feature which will add to the safety of the vessel is that all water-tight doors throughout the ship will be electrically controlled direct from the bridge. This means that in the event of accident of any kind, all water-tight doors throughout the ship can be closed within 15 to 30 seconds. Electrically operated boats davits will be employed, insuring great safety in launching boats.

The most-modern navigating machinery in force will form the bridge equipment of the new vessels. U. S. Navy type of compasses, Sperry gyro devices, radio direction finders, sonic depth finders, searchlights and a multitude of navigations aids will be employed.

A garage to accommodate one hundred cars will be part of the equipment of each ship. A machine shop to permit ordinary repairs and servicing of automobiles will be an adjunct of the garage unit. Cars will be driven aboard through side ports.

(*Continued on page 711*).

American Merchant Marine of Growing Importance

By T. V. O'CONNOR, Chairman United States Shipping Board

Construction Loans and Mail Contracts Help to Overcome High Building and Operating Costs; Private Operation Rapidly Developing Talent and Experience Necessary to Meet Foreign Competition

In 1916, when the Shipping Board was established, American shipping in the foreign trade was almost non-existent. During its first three of four years of life the Board, by one of those miracles that can be performed only in time of national emergency, built the greatest fleet of sea-going vessels ever completed within a comparable period. By this one great effort the United States raised herself from a negligible commercial position at sea to a place among the greatest of maritime nations.

The merchant fleet which the United States had in 1920 and 1921 was, however, a by-product of war and not an outgrowth of normal commercial development. It was owned by the government, which had no intention of remaining permanently in the shipping business. The situation was complicated by the fact that there was in the United States at that time no substantial body of shipping men, schooled in foreign trade and having the necessary contacts and prestige, at home and abroad, to enable them to compete on anything like even terms with the established shipping companies of foreign countries.

Nation Lacked Experience

There was not even a sufficient supply of American deck and engine-room officers, nor of citizen seamen. The truth is that we lacked experience in all the various phases of shipping.

In 1920 Congress had declared it to be the policy of the United States to do whatever might be necessary to develop and encourage the maintenance of an adequate merchant marine, and in the merchant marine act of that year had placed upon the Shipping Board the general responsibility for furthering the national interests in this respect. The merchant marine act of 1920 did not, however, give explicit instructions as to how the Shipping Board was to accomplish the desired end. Nor were funds provided beyond the capital represented by the wartime ships themselves and the willingness of Congress to appropriate money year by year for the Board's administrative and operating expenses.

It therefore devolved upon the Shipping Board to make such a start as existing laws would permit, trusting, meanwhile, that a more complete plan could be worked out as the necessary requirements were made clear by experience.

The first major task which the Shipping Board undertook after its reconstruction in 1921 under the terms of the new law was the determination of what shipping services the country actually needed. After an intensive study by shipping experts it was decided that the commerce of the United States called for regular service on 77 different trade routes, a number that was subsequently reduced to 38 by the consolidation of some lines and the abandonment of others. These do not include the private American flag lines and tramp services that were already in existence, nor was it supposed that the system of lines laid out by the Board would be a final one.

It was adapted to the needs of the country as the Board saw them at the time and was subject to modification or extension as conditions changed or new opportunities presented themselves. The Board's policy was not to have American vessels monopolize American overseas trade, but to build up a permanent fleet that would be capable of transporting more than half of our foreign commerce.

T. V. O'Connor, Chairman U. S. Shipping Board

Private Operation the Goal

The Board had the ships and was able to decide where and when to run them. But there was more to the problem than this. We must remember that the goal fixed by Congress in 1920 had been the establishment of a merchant marine owned and operated by private citizens. The ultimate hope and aim was to build up a shipping business, so far as possible, which would stand on its own feet, in much the same way as the steel business or the farming business or the mining business stands on its own feet. Everyone realizes that incidental help from the Government occasionally may be needed in any of these industries. But for the most part and in the long run they are expected to take care of themselves.

In order to build up the shipping industry under private American ownership and management it became necessary for the Shipping Board to develop American steamship companies where practically none had existed before; in other words, to get Americans into the shipping business. At first there was no possibility of persuading American business men to establish lines of their own. There were certain to be large losses during the development period, and no one had sufficient confidence in the future—in the possibility of successfully meeting foreign competition—to undertake such hazards.

The best that the Shipping Board could do in these circumstances was to turn over the operation of its lines to private companies, acting as agents of the Government, the Board paying all operating bills. Under this arrangement the operating agent managed the line, subject to the Shipping Board's supervision.

As soon as the major commercial problems connected with the new lines were solved and it became possible to look with some confidence into the future, the Government began to search for opportunities to place the individual lines in private hands. From 1923 to 1928 the chief means of bringing about a sale was the lowering of the price of the vessels to a prospective purchaser who would guarantee to operate the line for a stated term of years.

The lines in most cases still were operating at a loss, even without taking capital charges into account, so that if the Government received anything at all for the vessels and could be assured that the operation of a line would be continued, the transaction was a distinct financial gain for the Government. It had the further and greater advantage that the developing steamship company was now freed from Federal supervision and compelled to develop entirely on its own responsibility. Such sales were bringing an independent American merchant marine one step nearer.

Service Maintained

A considerable number of lines were sold under this arrangement, and with one early exception all did as well as could be expected, so that service on the respective routes continued to be maintained, though under private instead of Government operation. Incidentally, the cost of maintaining the Shipping Board fleet was very greatly reduced.

By 1928 it had become clear, however, that though a fair-sized merchant marine could be started in this way, shipping in

the United States was not yet strong enough to overcome the handicaps of higher building and operating costs, which are directly traceable to higher wage scales and higher cost of materials in this country. Thus, while the lines bought from the Shipping Board could run for a few years on the basis of their lower initial cost it was realized that they were not likely to accumulate replacement funds out of which to provide new vessels built in the United States.

This situation was effectively remedied by the Merchant Marine Act of 1928, which recognized that for some time American ships would be handicapped by higher construction and operating costs and which provided aid in the form of long-term contracts for the carriage of ocean mails. Under the provisions of this act the Postmaster General was to determine what trade routes were essential for American commerce, while the Shipping Board was to prescribe the types of vessels best suited to the respective routes.

Mail contracts were then to be awarded by the Postmaster General, who was given wide discretionary powers which he is now exercising with the advice of an interdepartmental committee appointed by President Hoover and consisting of the Secretary of Commerce, Secretary of the Navy, Postmaster General and chairman of the Shipping Board.

The Merchant Marine Act of 1928 also enabled the Shipping Board to grant more liberal construction loans, for as much as three-fourths the cost of new vessels, with the repayment period extending over 20 years, at low rates of interest.

Act Stimulates Construction

The act has greatly stimulated the construction of new ships, the starting of new shipping lines and the expansion of old ones. Already more than half of all the Shipping Board lines have been sold to private American interests. Many of the Board's remaining lines probably will be sold in the not distant future. In addition, old-established steamship companies, American controlled but formerly chiefly foreign in flag, are being transferred to American registry. Trading companies which formerly were primarily carriers of their own products are becoming common carriers. From all sides there is springing into existence a truly American merchant marine.

Lines Operated on Their Own

While the near future probably will see nearly all of the Shipping Board's lines disposed of to private interests, it is likely that the board will continue to own a few lines for some time to come. On the lines still in its possession the board lately has been putting into effect a new policy, under which the operating agent becomes for all practical purposes an independent shipping company.

Instead of meeting bills for operations, as was formerly the practice, the Shipping Board, under the new arrangement, pays the operator a fixed lump sum for maintaining a service that is not sufficiently developed to be sold, at the same time requiring the operator himself to pay the bills. The latter is thus compelled to operate as though the line were his own. The result is that the Shipping Board avoids all but the most general supervision and the operator is left free to work out his own policies.

Since 1928 it may be said, therefore, that in more ways than one the center of gravity in American shipping has shifted from government ownership and operation to private ownership and operation. The government, by means of mail contracts and construction loans, is extending material help to the new American shipping industry, but the industry is largely thrown on its own resources, so far as skill, business contracts and established position with the public are concerned.

Seventy Vessels to be Built

While it is hazardous to make predictions, it is reasonably safe to say that the immediate future of American shipping is brighter than that of any other country. We are already second in shipbuilding among the maritime nations. Mail contracts already awarded, or in process of award, call for the construction of seventy vessels, valued at approximately $277,000,000. This building program will of itself not give us a great merchant marine, but it will give us an excellent one, and will provide an opportunity to our shipyards and shipping men to try themselves out.

I see no reason why Americans should not prove as efficient in shipbuilding as they are, for example, in steel making, bridge building and skyscraper erection. I fail to see why they cannot operate shipping lines as successfully as they run railroads, hotels and moving pictures. Americans should be as capable as foreigners in meeting the transportation needs of American travelers and shippers. And our opportunities are unlimited, for Americans have become the world's greatest travelers, the world's greatest importers and exporters. Having grown great in banking, in manufacturing and in trading, I can see no reason why America should not become great in commercial shipping.

Calls Future Bright

The same strength of capital, of management, of labor, of resourcefulness that has built up our great industries ashore and that has lately extended the field of our industrial activities into all lands should enable us to hold our own in the business of ocean transportation. There are still numerous obstacles to be overcome. The cost of operating American ships must be greater for some years than that of operating foreign ships.

But we are rapidly developing the talent and experience that should enable us to regain the maritime prestige which we enjoyed in the days of "wooden ships and iron men." In other words, we are as fit to excel to-day in the age of machinery as we were eighty years ago in the age of the clipper ship. From whatever angle we view the future of American shipping, we can assure ourselves that it holds great promise along the lines of progress and high achievement.

Chickens Come Home to Roost

(*Continued from page 658*).

as a means of helping themselves, still abound. Europeans and Americans could not see before so clearly the close relation and interdependence between China and their own countries. They can see it now. They can see that if they want to alleviate their economic troubles, the only way is to help China consummate Dr. Sun's scheme. The time is therefore bound to come when Dr. Sun's scheme will materialize. We can no longer treat it as a vision.

While China wishes to avail herself of an opportunity for the development of her industries, we must not overlook one important point, *i.e.*, Dr. Sun's statement in his Preface "*If the power of development remains in our hands, we thrive, otherwise, we perish.*" It is fitting and proper for us to utilize foreign capital for our industrial development, but as to how it will be utilized, we must follow Dr. Sun's instructions. Here I repeat if the power of development remains in our hands, the development will be wonderful; otherwise, China will perish. This is the fundamental principle in the International Development of China.

But how can we reserve the power of development to ourselves? The only way is by the abolition of extraterritoriality. As long as extraterritoriality remains, all foreign industries and commerce will remain in the foreign concessions and settlements unreachable by Chinese laws. From our point of view, when complications arise, extraterritoriality will be their wall of defense. Such special privilege tends to develop economic imperialism. In that case, China can not be benefitted by international development and incalculable harm will be done to her. Far-sighted foreigners feel the necessity of its abolition. They advocate it. Why? Because with the existence of consular jurisdiction, they cannot cultivate close friendship with the Chinese people, they can not transact with the Chinese as much business as they ought; in short, their trade cannot properly develop. Consequently, they suffer more from the loss of business than they get out of their special legal privilege. From this, we can see that Dr. Sun's plan, when worked out in accordance with his instructions, is beneficial to both.

Realizing that Dr. Sun's plan is the best for our construction, I specially bring it to your attention to-day with the hope that more thought will be given to it.

The Fish-Treating Steamship "Seapro"

A RECENTLY completed undertaking, which will be of more than ordinary interest in those countries engaged in the fishing industry, is the fish treating steamship *Seapro*, of which we are able to publish the full particulars, together with reproductions of interesting photographs taken on board this vessel.

The *Seapro*, of which we give a view, is going out to the coast of Africa to catch fish, in general, and to convert that fish on the spot into the most useful commercial commodities which it will provide, being in effect a floating factory capable of being taken to wherever fish is most plentiful, and capable of utilizing every particle of the fish caught, there being no waste whatsoever.

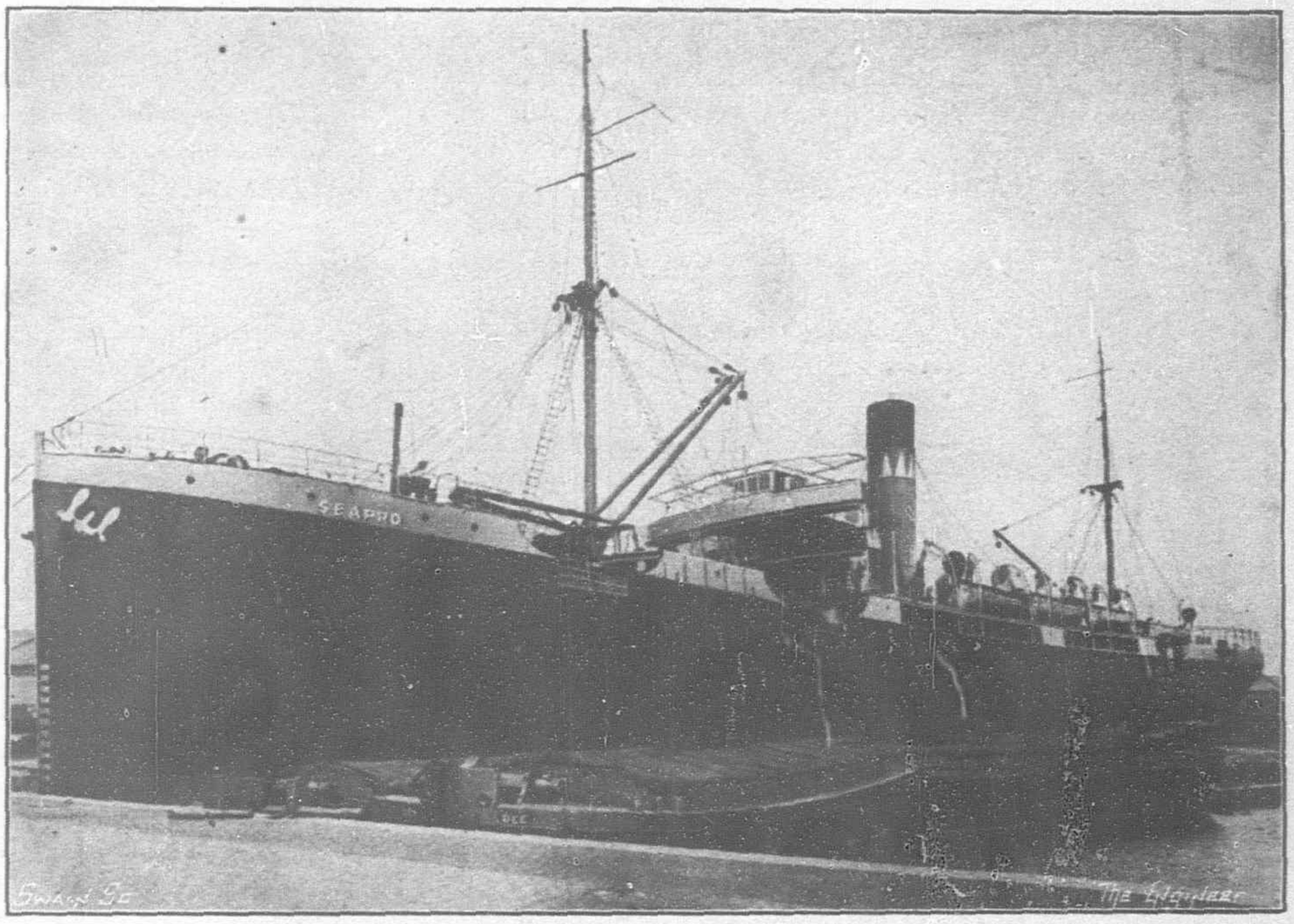
The *Seapro* is not exactly a new ship, having been engaged under another name in trading in the East, and thus, being equipped with a great amount of machinery for her new occupation, considerable ingenuity was required for its introduction without the disturbance of her main structural features. The Plant on the ship has been designed and erected largely by Messrs. Rose, Downs & Thompson Ltd., of Hull, London, and Shanghai, who specialize in the construction of fish meal plant, the object being to utilize the catch to the utmost advantage.

It is intended that a fleet of motor boats will do the actual fishing and it is anticipated that these boats will bring to the parent ship from 60 to 100 tons of fish every 24 hours.

Fish of all kinds is caught in the waters of South West Africa, some of which is only fit for conversion into cattle, pig and poultry feed; some are most valuable for their oil content; others have livers that provide a valuable medicinal oil, whilst there are shellfish that furnish a table delicacy when tinned. Finally, some fish caught in those waters are worth putting into cold storage for sale at any convenient market.

The *Seapro* is provided with equipment for dealing with all these classes of fishes and several items of the plant are illustrated, while the general arrangement of the fish meal machinery and solvent oil extraction plant is shown in the drawings given herewith.

In such an enterprise as that of the *Seapro*, one of the first matters to be borne in mind is that the average content of water in fish is from 70 to 75 per cent and that the ship must not be encumbered with such a proportion of valueless material. As a consequence, the greater part of the catch has to be passed through dryers to drive off this moisture, which has to be treated with discrimination, as we will explain. In view of the great amount of moisture which has to be evaporated from the fish it might have been reasonably expected that auxiliary boilers would have to be installed to supplement the supply of steam from the ship's boilers, but such is not the case. Due to the low steam consumption of the drying machinery and the fact that the ship will seldom work except when at anchor, it has not been found necessary to increase the normal boiler capacity of the ship.



S.S. "Seapro"

Another point which has had to be taken into consideration in the general arrangement of the ship is the fact that the crews for the fishing boats will be recruited locally, but will live on board during their spell of service, so that extensive native quarters have had to be provided forward. It will thus be understood that for her size of 5,305 deadweight tons, the *Seapro* carries a large equipment.

Dealing first with the procedure with the coarser kinds of fish, whether they be of the "white" or oily variety, they will be hoisted on deck from the fishing boats and dumped pell-mell down shoots into hacking machines, one on either side of the vessel, 'tween decks. These machines, see Fig. 8., comprise two pairs of rolls built up of a series of toothed plates rotating at slightly different speeds, so that they tear the fish into small pieces, and so powerful are these rolls that a fish as large as a man has been known to pass through without stalling them in the least. The power required for driving the rolls is 15 h.p.

From the hackers the mushed material drops down into two drying machines, one on either side of the hold, one of which is illustrated in Fig. 5. Previously to being introduced into the drying cylinders proper, the fish is, however, first passed through a sterilizing chamber seen at the top of the machine in Fig. 5., where the albumen is coagulated and any noxious bacteria killed by being subjected to the temperature of steam, in the jackets, at a pressure of 35 lbs. per square inch. The passage of the fish through this chamber is effected by a screw conveyor and is comparatively rapid, as the only requirement is that the meal should be raised to a sufficient temperature for sterilization before it is subjected to the slower process of drying.

The drying is effected in four parallel cylinders, which are steam jacketted. These jackets are all electrically welded in place and are supplied with steam at a

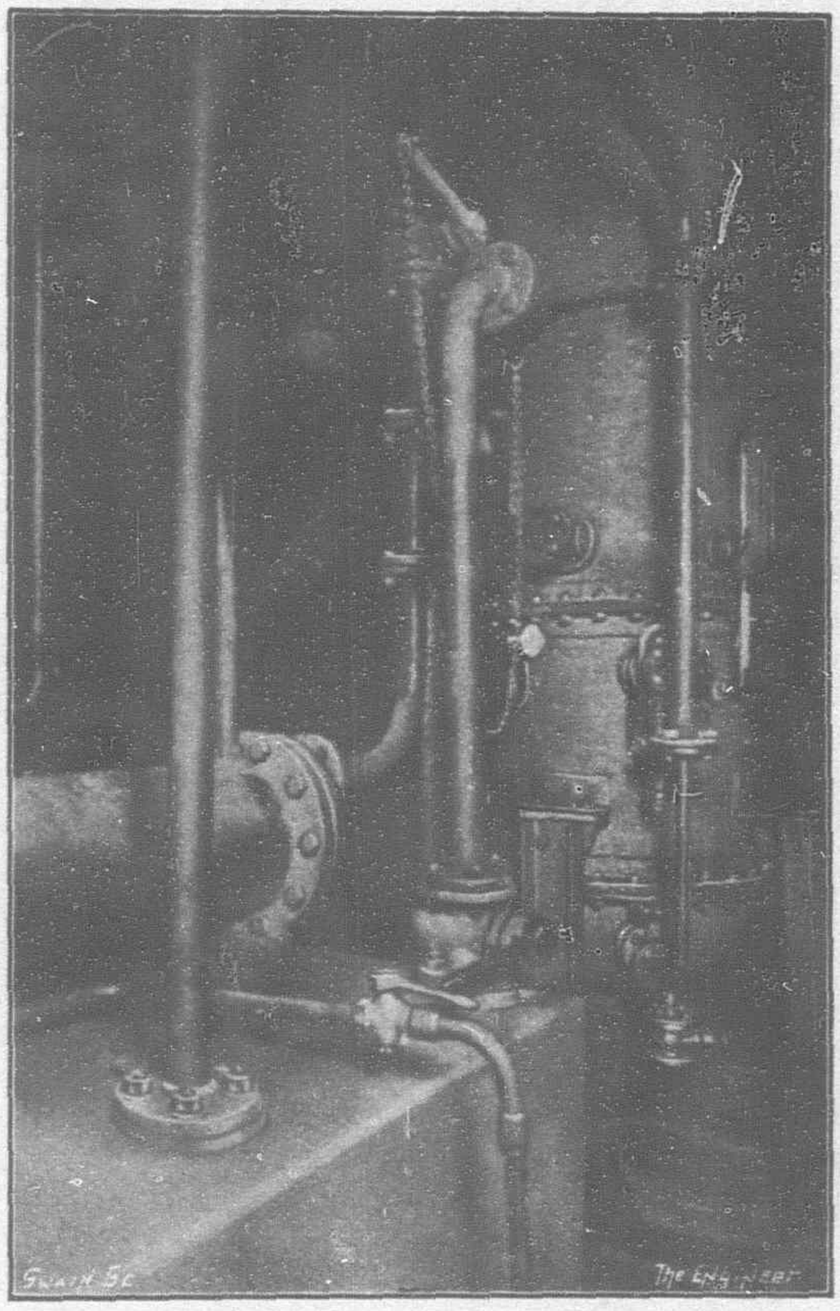


Fig. 3.—The Still Room

low pressure. They are elaborately equipped with steam traps for draining off the condensate and with safety valves to prevent over-pressure. The jackets are not carried right round the circumference of the tubes to the top as that part is required for a series of inspection doors. Within each tube there is a longitudinal hollow shaft equipped with blades for moving the material forward. This shaft, also, is provided with a steam supply, and the meal, in being propelled forward, tumbles over the shaft and is, consequently, subjected to an intensive drying action.

The electric motors for driving these machines, and, incidentally, the cross conveyors referred to later, are each of 25 h.p. They are fixed on the forward bulkhead and are belted to the pulley seen on the right in Fig. 5. From there the drive is through worm reduction gear and roller chains to the several shafts of the machine. The speed of the conveyor shafts is so arranged that the fish passes through the machine in approximately 2½ hours.

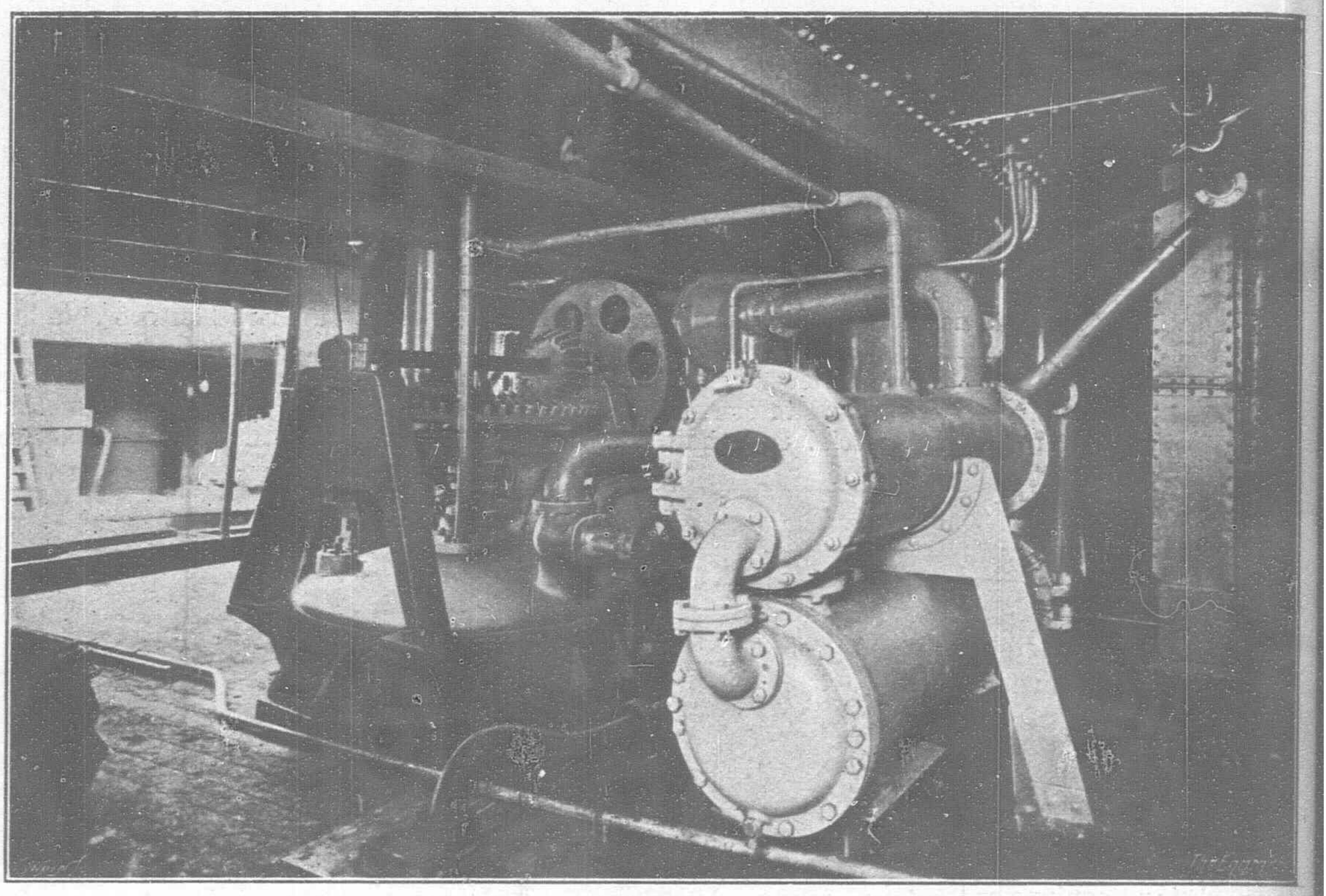


Fig. 10.—Condensers and Top Gear of Extractor Vessels

In the process of drying, large quantities of steam are, naturally driven off, and this steam contains a certain proportion of vapor of a rather offensive nature. So the whole of the steam is collected by an elaborate system of trunking—as shown in the line drawing, Fig. 2—and is drawn away by two exhaust fans, one of which can be seen in the background of Fig. 8. It is then passed through a series of three condensers—see Fig. 2—which are cooled by the circulation of sea water, the condensate being discharged overboard. There is a slight remainder of uncondensable gas, and this is sent into the boiler flues for incineration.

At the discharge end of the drying machines there are two thwartships screw conveyors, see Fig. 2, into either of which the dried fish meal can be discharged by means of an arrangement of shoots and dampers. These conveyors deliver the meal into the boots of two elevators, marked "A" and "B" in Fig 1. The reason for having two conveyors and two elevators is that it may happen that both white and oily fish are being dried at the same time in the two drying machines, or it may be that one class is being handled by both dryers. Consequently, both conveyors are arranged that they will feed either elevator from either dryer. The elevator "A" is reserved for white fish meal, while "B" handles only oily meal.

Taking first the white meal, the elevator "A" delivers into a slightly inclined water-jacketted screw conveyor arranged on the main deck—See Fig 1.—which acts as a cooler, as the meal is still quite hot. The cooler, in turn, delivers into a short elevator which discharges down a spout in which is fitted a magnetic separator for taking out fish hooks, etc., the meal finally falling into the grinding machine that reduces the bones and hard particles and delivers into a separator below. The oversize from this screen is returned to the grinder by another elevator, while the fine-ground meal drops direct into bags ready for the market. It will be noted that throughout the process, from the time that the fish is first dropped down the shoots to the hacking machines, all the operations are carried out automatically, and that no hand labor is required except that necessary for tending the machinery.

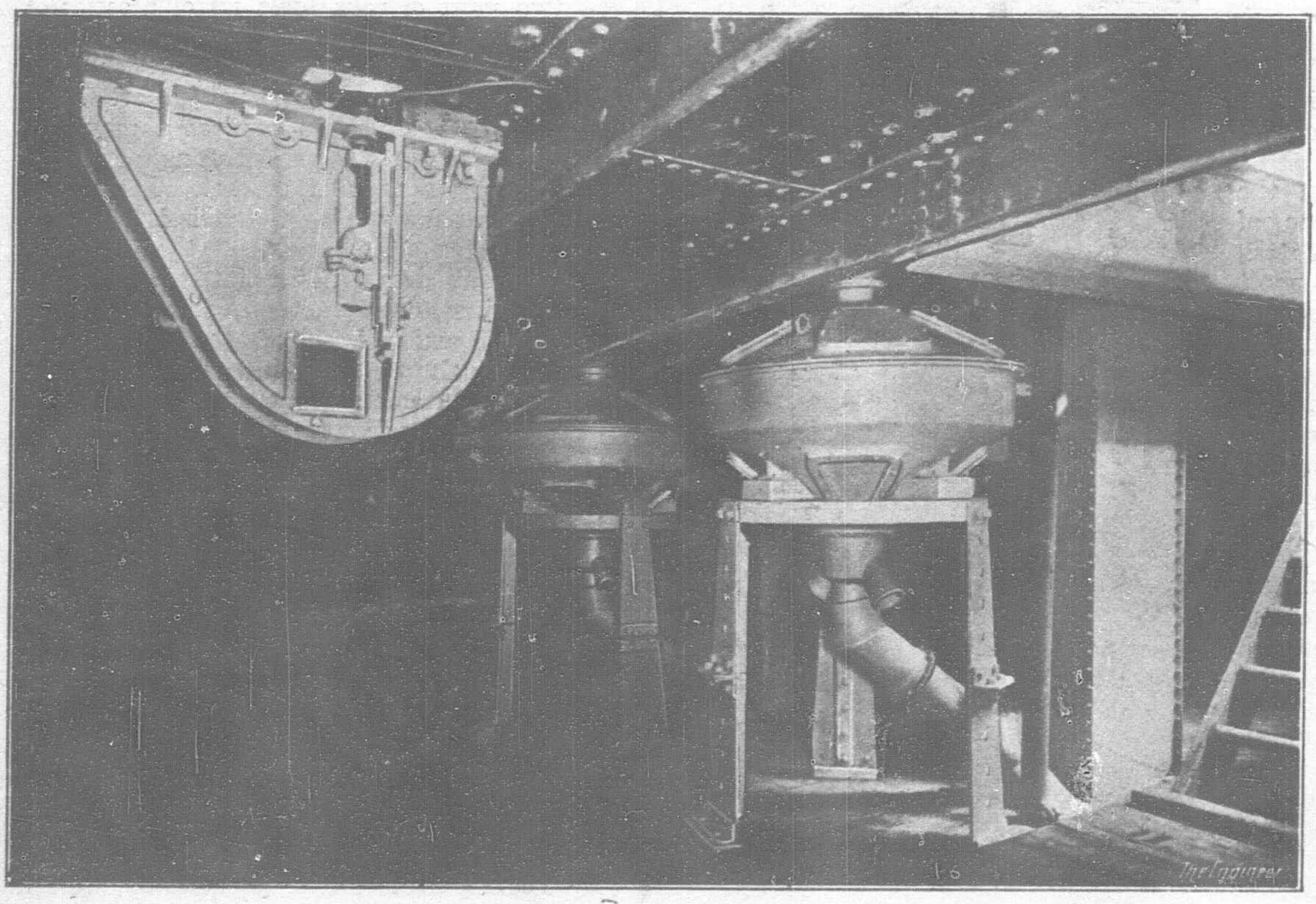


Fig. 11.—Separators Below Meal Grinders

Oily fish meal delivered by the elevator "B" passes through an entirely different process for the extraction of the oil, which is a valuable by-product. This process is of the intermittent or batch type, so the elevator delivers into a large bin on the spar deck—see Fig. 1. From this

FISH PRODUCTS EQUIPMENT OF THE S. S. "SEAPRO"

Rose, Downs and Thompson, Ltd., Hull, Engineers

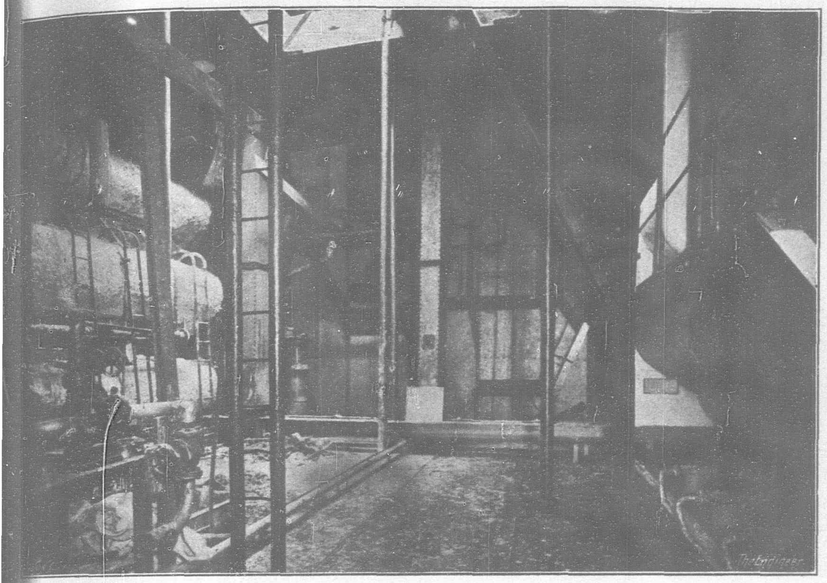


Fig. 4.—Fish Meal Drying Machines with Cross Conveyors and Elevators

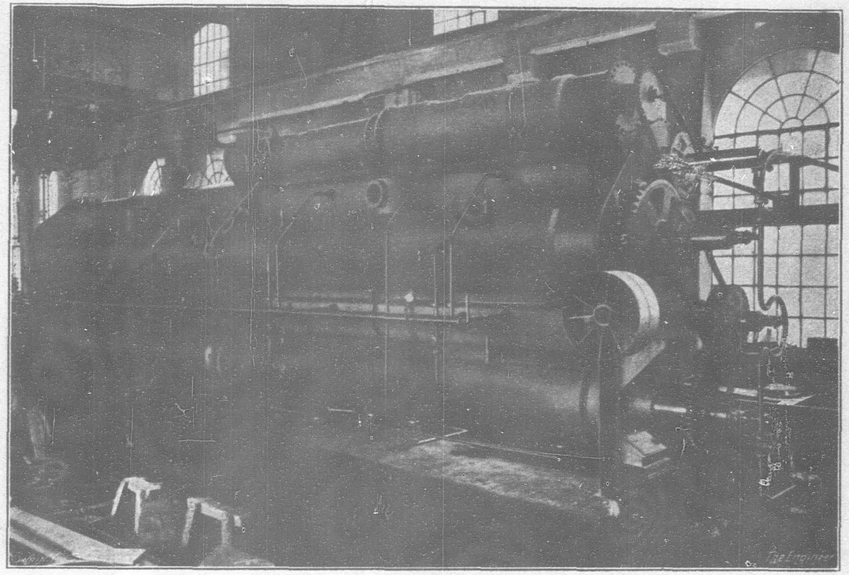


Fig. 5.—Fish Meal Drying Machine and Steriliser

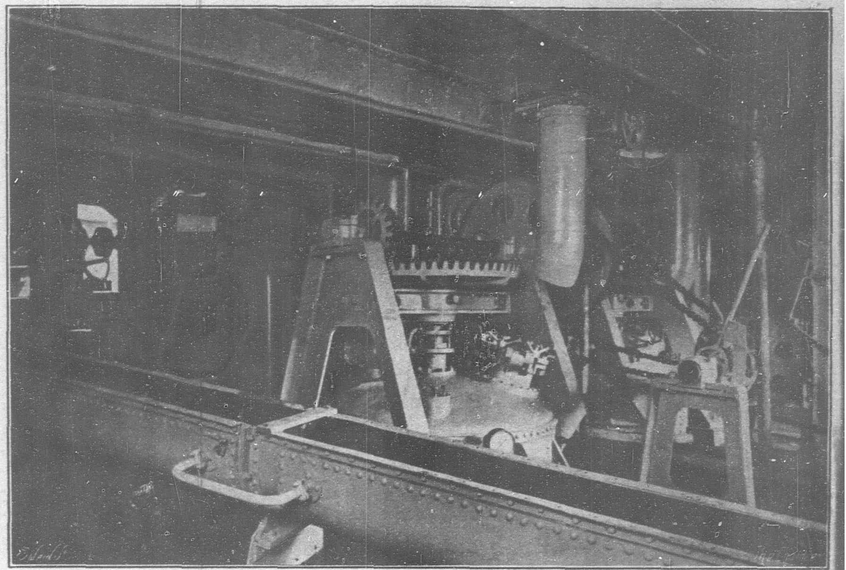


Fig. 6.—Stirring Gear of Extracting Vessels

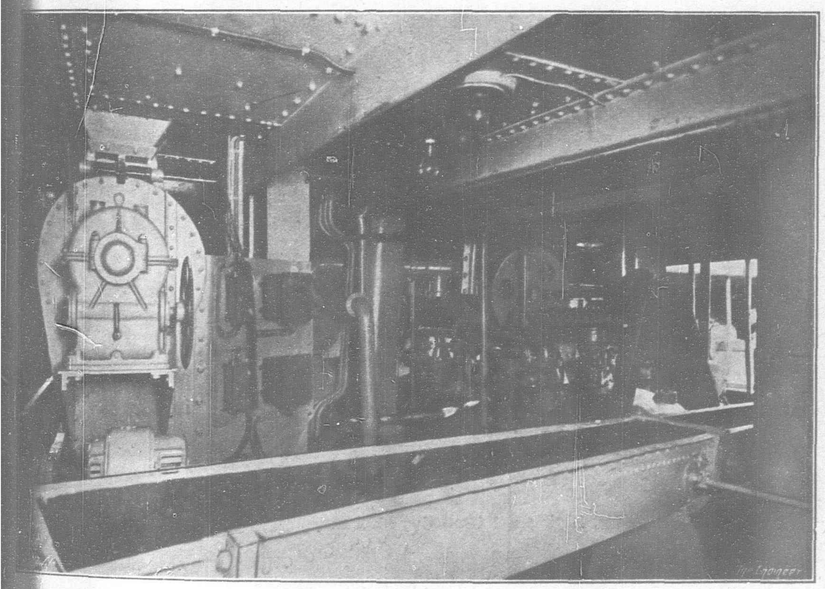


Fig. 7.—White Meal Cooling Conveyor and after Dryer

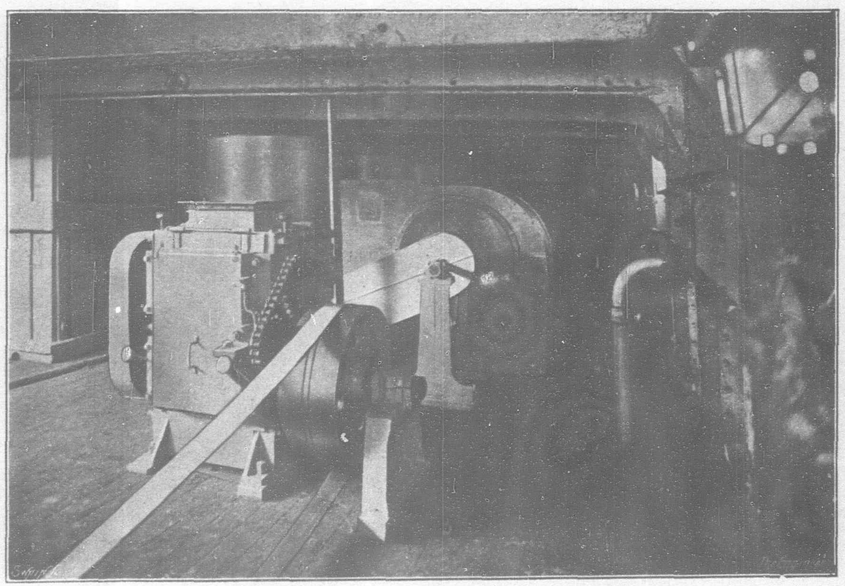
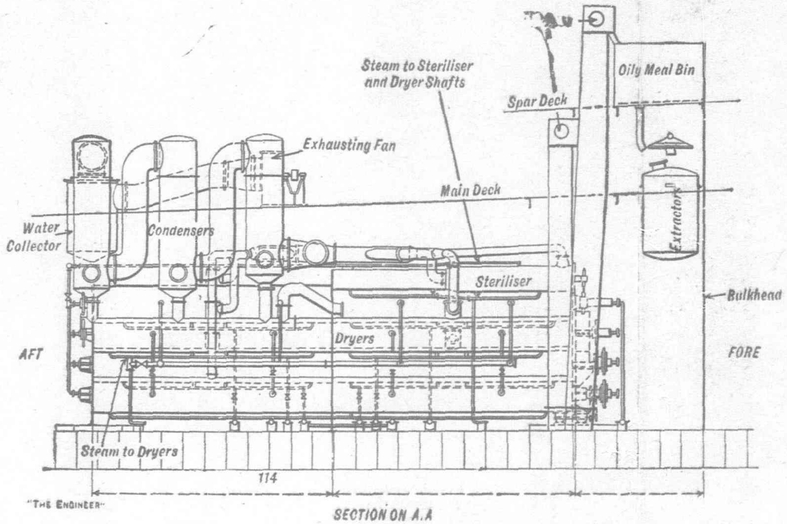


Fig. 8.—Fish Hacking Machine and Vapor Exhausting Fan

Fig. 9.—White Meal and Oily Meal Elevators



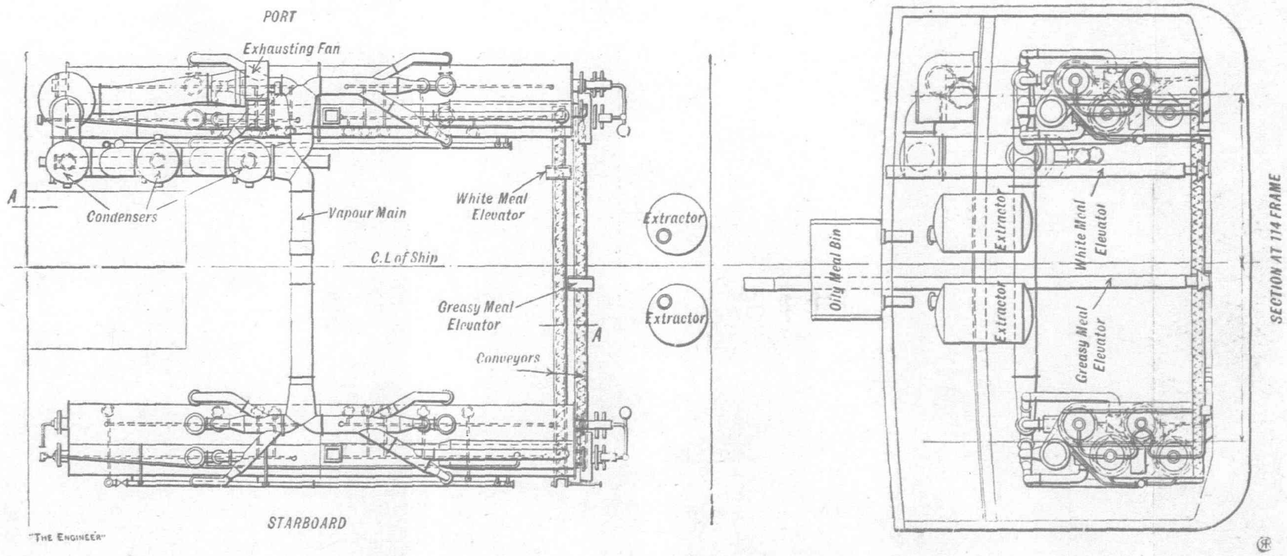
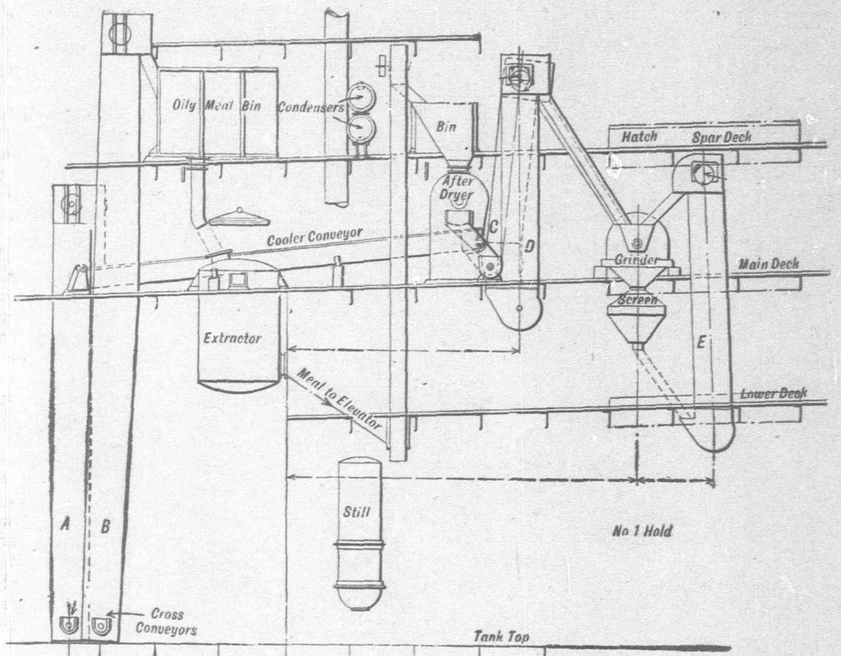


Fig. 2.—Arrangement of Dryers and Steam Collecting Mains



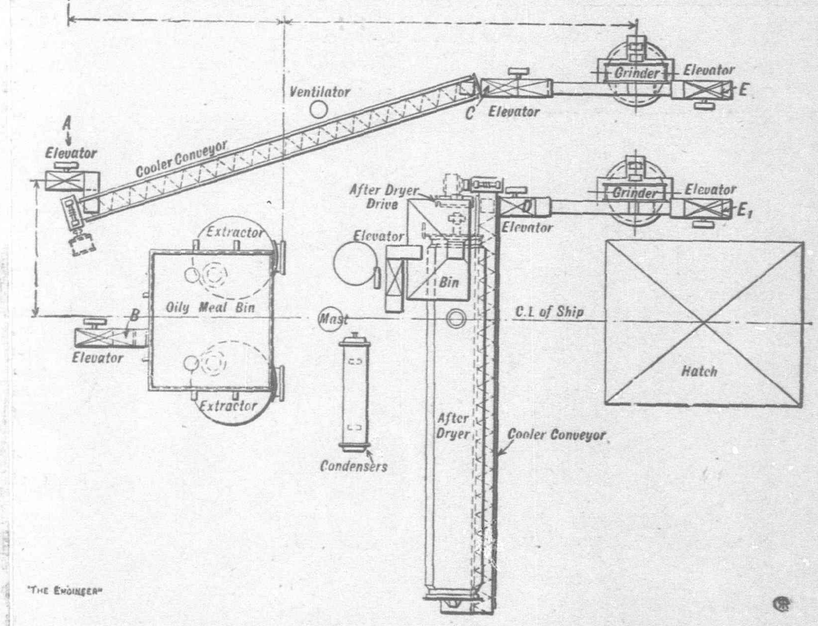


Fig. 1.—Arrangement of Grinding, Drying and Conveying Machinery

bin the material is dropped down shoots into either one of two oil extractors, on the deck below.

These extractors take the form of large vertical cylinders, each of which is capable of accommodating two tons of average fish meal. Into these cylinders the charge is introduced by means of moveable shoots. For dissolving the oil from the meal trichlorethylene is used. This particular solvent has the merit that it is non-inflammable and is also readily recoverable in its entirety, though other solvents can be used. Hot solvent is admitted to the extractor by means of valves which are so arranged that the liquid may enter from the top or the bottom of the vessel. After the first wash of solvent has become saturated with oil it is drained off through a filter and passed into distilling apparatus. The vaporized solvent is condensed in the surface condensers situated just forward of the extractors—shown in Fig. 1, and passes *via* water separators to the solvent store tank for further use.

Several washes of solvent may be required before all the oil is removed from the meal. Provision is made for the further use of partially saturated solvent in the first washings before it is passed to the evaporator, thus conserving steam. The fish oil is pumped from the evaporator into tanks or barrels.

When all the oil has been recovered from the meal and the solvent as far as possible drained off, live steam is admitted to the extractors. This vaporizes the remaining solvent, which is condensed and recovered. To facilitate this steaming-off process the meal is stirred up by means of forged steel stirrers or arms fixed to a vertical shaft and rotated through bevel gearing. An electric motor serves to drive the stirrers for the two vessels and is connected up by clutches and roller chains

The meal discharged from the bottom of the extractors is practically free from oil and solvent, but it is moist, on account of the steaming process, so it is re-elevated and passed through an "afterdryer"—see Fig. 1—very similar to one of the cylinders of the main drying machines. The meal is then taken back by a cooling conveyor and passes through the same process of grinding and separation as does the white meal.

In the after part of the ship there is a complete tin can making plant for making tins, boiling and canning such stuff as crayfish, lobster, crab, etc., and another plant for the boiling out of the oil from fish livers; but as the mechanism of the former section is no doubt familiar to our readers and the latter is of simple form, we need not discuss them in detail here. The refrigeration apparatus on the ship also is of normal design.

We may mention that though our description has applied particularly to this floating factory, such an industry is not necessarily confined to the somewhat narrow limits allowed by its erection on shipboard, since similar installations are working on land at many of the fishing ports, and where once fish offal and waste fish were a serious problem,—due to putrefaction setting in so quickly and there being no adequate means for the disposal of this material—now the fish meal industry has become a most important and profitable one. One such factory, capable of handling many hundreds of tons of fish per day, and situated at one of the largest fishing ports on the North East Coast of England, is worked upon a co-operative basis in which all the trawler owners and fish merchants have interests, and thus, instead of there being a number of smaller factories, each competing in the market for their products, this large factory handling all the raw material available in the port, is enabled to work at the utmost efficiency.

In the modern machinery, as described in this article, fish wastes which were once regarded as of little value, are converted into a feeding meal of the highest quality. This meal is light in color, light in weight, and of bulky appearance, also being absolutely free from any offensive odor, whilst at the same time it possesses the highest percentage of albumenoids. With this latest machinery too, there is no offensive odor given off from the factories, means being provided for the complete destruction of all offensive gases generated, and in many instances fish meal factories are functioning in thickly populated towns, causing no nuisance whatever.

Chinese Service to South Seas

Plan for the inauguration of a regular shipping service to the South Sea Islands will shortly be operated by the China Merchants' Steam Navigation Company. Four 8,000-ton steamships will be chartered to sail between Shanghai and the islands. The materialization of this scheme, it is stated, will be the first step towards the expansion of Chinese shipping and the prelude to the establishment of an ocean service.

Launch of the "President Hoover"

(*Continued from page 706*).

The public rooms, lounges, and writing rooms of the two vessels will be identical marvels of comfort and art. Indirect lighting will be the system of illumination.

The main entrance lobby off the promenade deck will be a spacious room with inlaid walls of satin wood and pilasters of walnut and gold. The room will be enhanced by a spouting fountain built in mosaic.

The main lounge, a spacious room 45 by 53 feet, will be set off by walls of carved satin wood and ivory panels. The furniture, carpets, and hangings were specially made for this room as well as for all other public rooms, of the vessels. Talking picture equipment, a stage and an inlaid dance floor will be among the entertainment attractions offered.

Art of the Spanish-California type will mark the smoking room with walls of well matched wood. Opposite the fire place will be a tapestry executed by a group of nationally known artists illustrating an episode in the story of Rip Van Winkle. This room will be designed for the fair sex as well as for male occupancy.

At the forward end of the promenade deck, connected to the main lounge by panelled doors, will be the writing room. Five French-windows, art furniture of unique design and bright hangings will add to the comfort of the room.

The library will be a spacious room with soft, indirect lighting. Inlay and hard wood will form the decorative scheme .

Possibly one of the most popular public rooms will be the Veranda Cafe, which will run the full width of the ship and will have a semi-outdoor atmosphere when desired through opening the long Laycock windows. Teakwood floors, ornamental well panels, palms and tropical verdure will make the room exceedingly cheerful.

Directly off the veranda cafe will be the soda fountain, a gaily colored room, dotted with chairs, tables, and booths.

On the boat deck above will be a spacious swimming pool done in a sea-green tile. On the navigating bridge deck space is provided for miniature golf, tennis, and other games.

One of the special features of these new liners will be the gymnasium, complete in every respect, which will be located on the port side of the boat deck, just forward of the swimming pool. This will be an "L" shaped room, approximately 20 feet long by 19 feet wide, with an 8-foot ceiling. This gymnasium, which will be on par with any first class one ashore, will be electrically equipped throughout. In addition to the standard equipment found in all gymnasiums, there will be a therapeutic room, massage table, riding horse, abdominal machine, and ultra-violet ray equipment. Adjoining the gymnasium will be electrically heated locker rooms, showers and baths.

Another recreational feature, in the form of a children's playroom will be located on the boat deck, just opposite the gymnasium. This playroom will be slightly smaller than the gymnasium but entirely adequate, and will have all the modern features found in playrooms. A slide, merry-go-round, blackboards, sand boxes, children's books, and toys for the children of all ages will be found in this up-to-the-minute playroom.

In addition to the broad staircases which lead to all decks, two elevators will give service. The stairway lobbies on each deck will be extensive, finished in hard wook, and lighted by the indirect system.

A novelty shop will be located in the main lobby of the first passenger stateroom deck. This shopping space will be equipped with brilliantly lighted show cases which will display a variety of goods appreciated by travelers.

Passenger staterooms will be generous in size, with two standing beds, dressing rooms, and private or detached baths.

The special class division of the ships will be equipped with spacious staterooms and extensive public rooms. All drapes, furniture, decoration, and art work in the special class division will be executed with artistic care. Smoking room, lounge, writing room, and swimming tank will be among the conveniences afforded.

There will be a telephone in every room, operated from a central station, not only giving telephone service at sea, but equipped to handle local and long distance messages while the ships are in foreign and domestic ports.

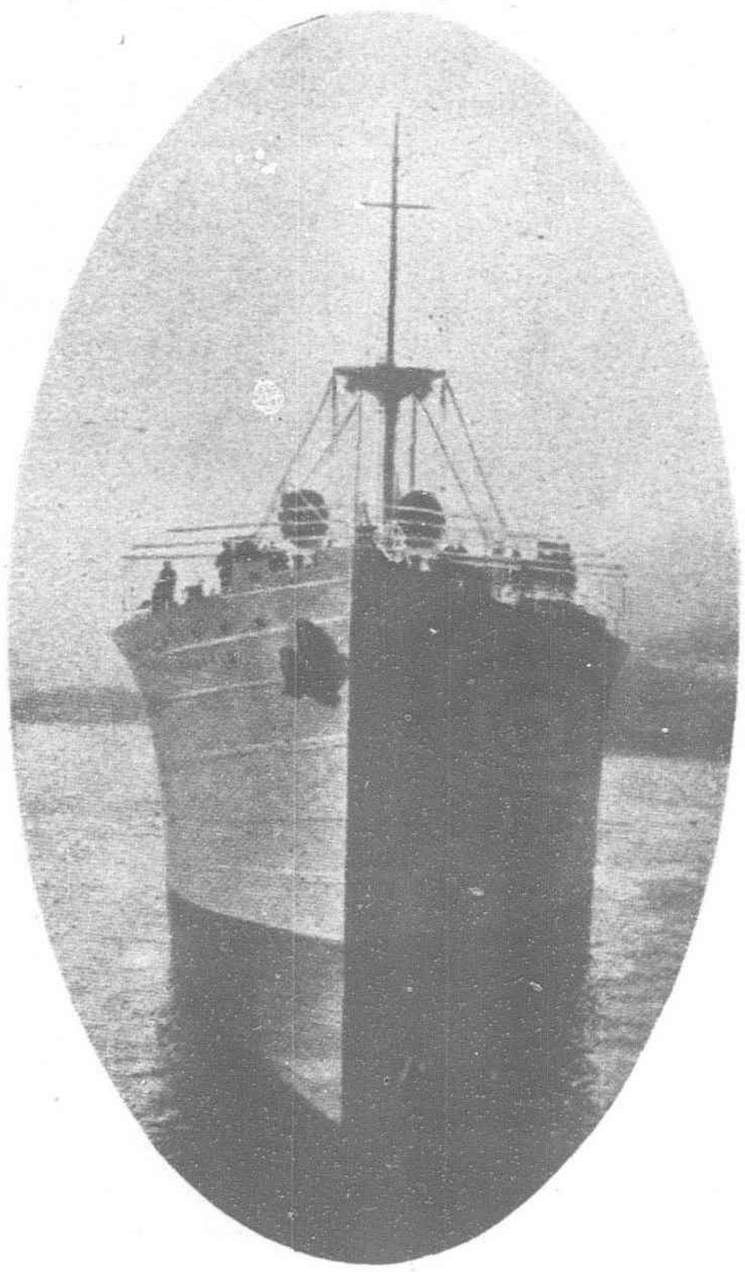
The First Twin-screw Silver Liner*

A New 14½-knot 9,600-ton Vessel with Richardsons, Westgarth-Doxford Machinery of 5,500 b.h.p. Up-to-date Auxiliary Equipment for a Ship on a Round-the-world Service

Up to the present time the program of motor ship construction undertaken by Messrs. Stanley and John Thompson, owners of the Silver Line, has consisted wholly of single-screw vessels and a dozen of these ships have been in operation for an appreciable period, No steamers are to be found in this fleet, for none has been ordered ; on the other hand, in addition to the *Silverpalm*, the first twin-screw Silver liner, there are six more motor vessels on order, so that this enterprising concern will, at no great length of time, own nearly a score of oil-engined ships.

The *Silverpalm* was built by Messrs. J. L. Thompson and Sons, Ltd., Sunderland, the propelling machinery being constructed by Messrs. Richardsons, Westgarth and Co. It is of the Doxford two-stroke opposed-piston type. The control stations, are at the forward end of each engine : The auxiliary engines in the *Silverpalm* are of the Allen-B. and W. four-stroke trunk-piston type.

The equipment on the *Silverpalm* is in every respect up to date. Electricity is employed for practically all the auxiliary services and the galley is of the all-electric type, whilst electric heaters are fitted throughout. An exhaust-heat boiler is installed to receive the gases from the dynamo engines ; details of these and other features will be given at length in the course of this article. In the following table will be found the leading particulars of the vessel, which is to maintain a round-the-world service, operating from New York.



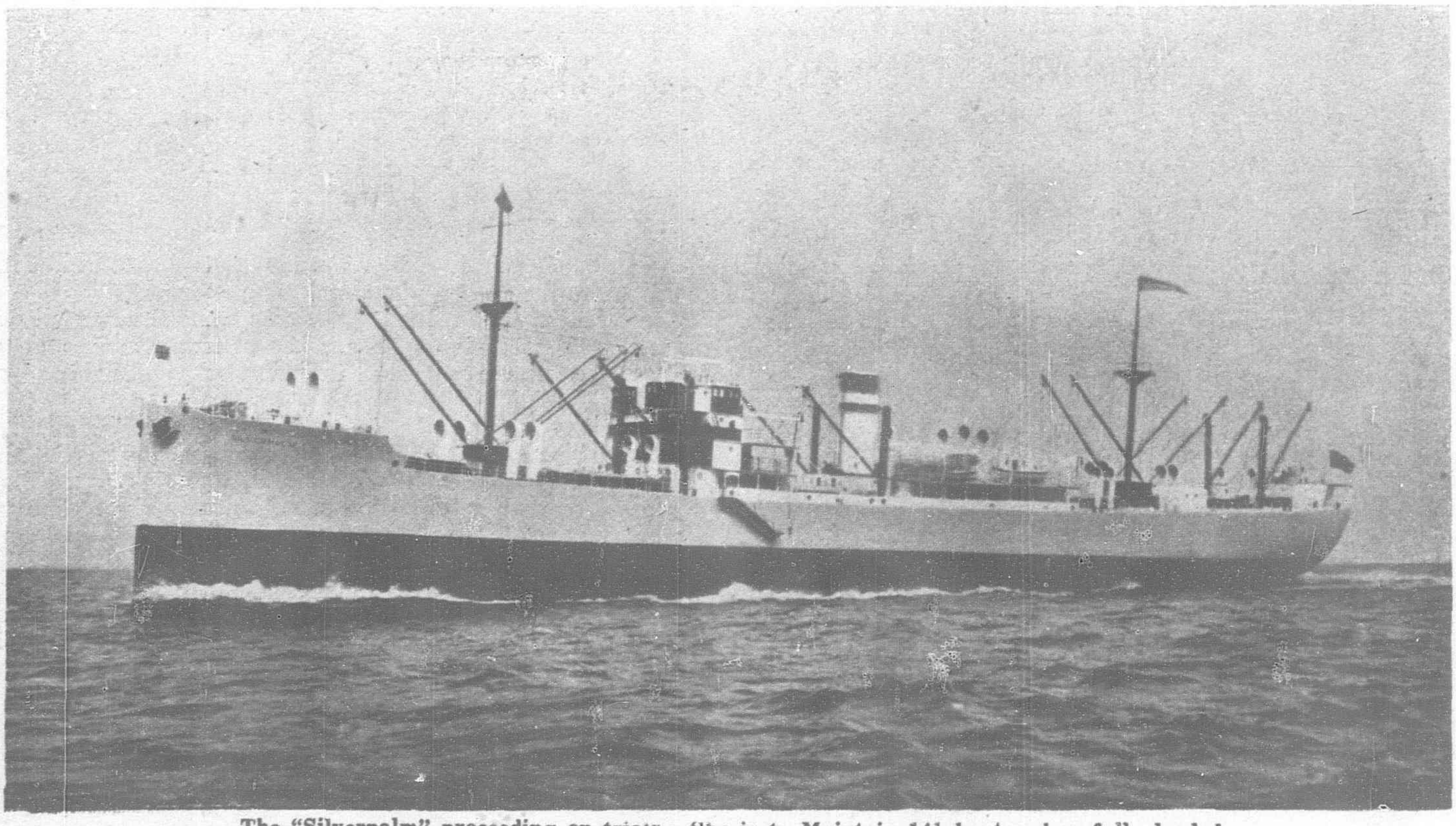
The "Silverpalm" leaving dock for the trial trip

Principal Features of the M. S. "Silverpalm."

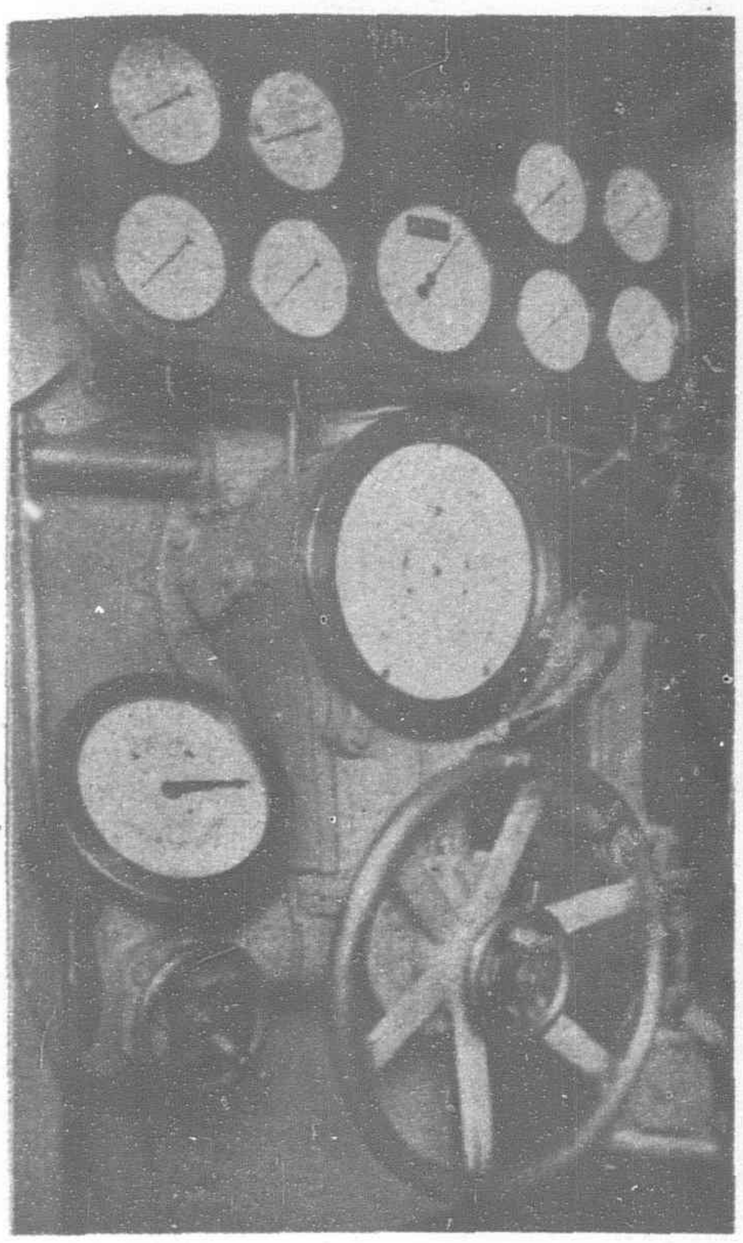
Length between perpendiculars	450 ft.
Breadth, extreme	61 ft. 4 in.
Depth, moulded, to upper deck	39 ft. 6 in.
Depth, moulded, to second deck	30 ft.
Deadweight capacity... ...	9,600 tons.
Gross register	6,373 tons.
Net register	3,385 tons.
Service speed, loaded	14½ knots.
Machinery output, total ...	5,500 b.h.p.
No. of cylinders, each engine	4.
Diameter	600 mm.
Stroke	1,800 mm.
Revolutions	112 per min.
Auxiliary engine output ...	600 b.h.p.

The vessel is classified as a complete superstructure type with freeboard and is built to Lloyd's 100 A1 requirements. Upper and lower 'tween decks, together with Nos. 1 and 2 main holds, are forward, Nos. 3 and 4 holds being deep tanks. Aft of the engineroom are Nos. 5a and 5b holds, which are for the carriage of insulated cargo, each having a capacity of 28,000 cubic ft. Above these and No. 6 hold aft are upper 'tween decks. The main refrigerating machinery

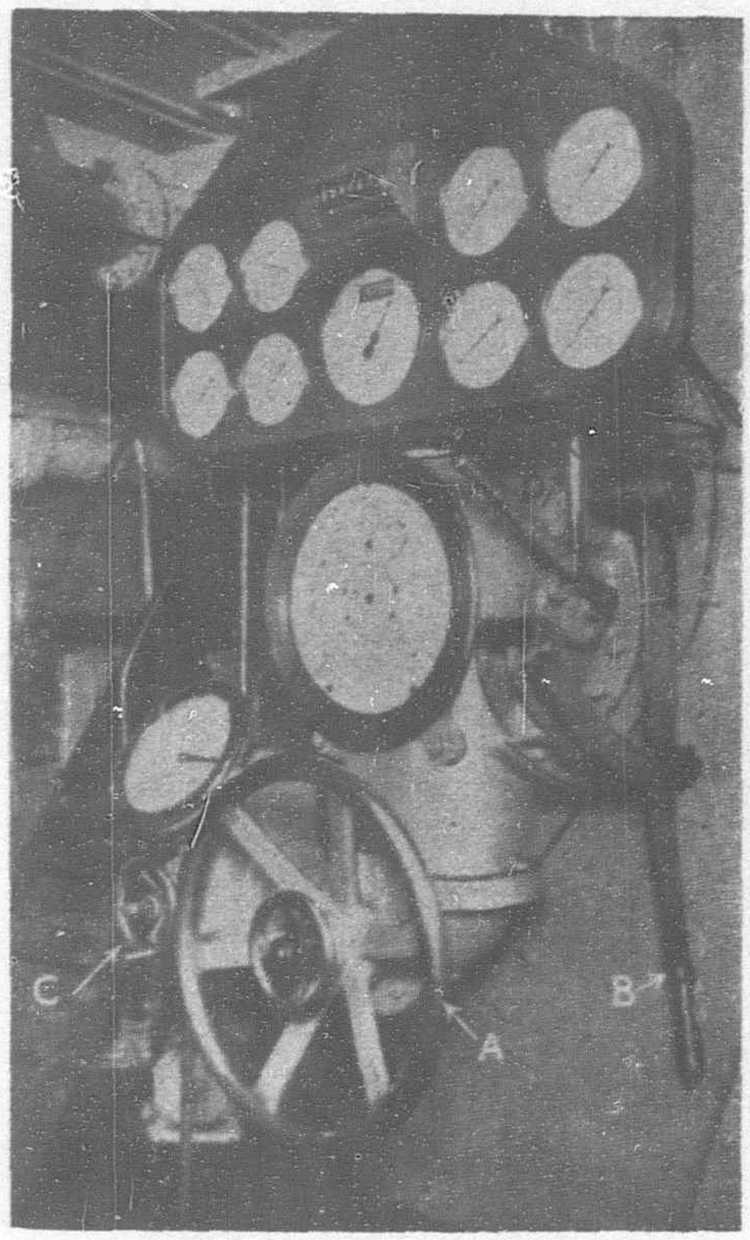
* From the "*Motorship*"



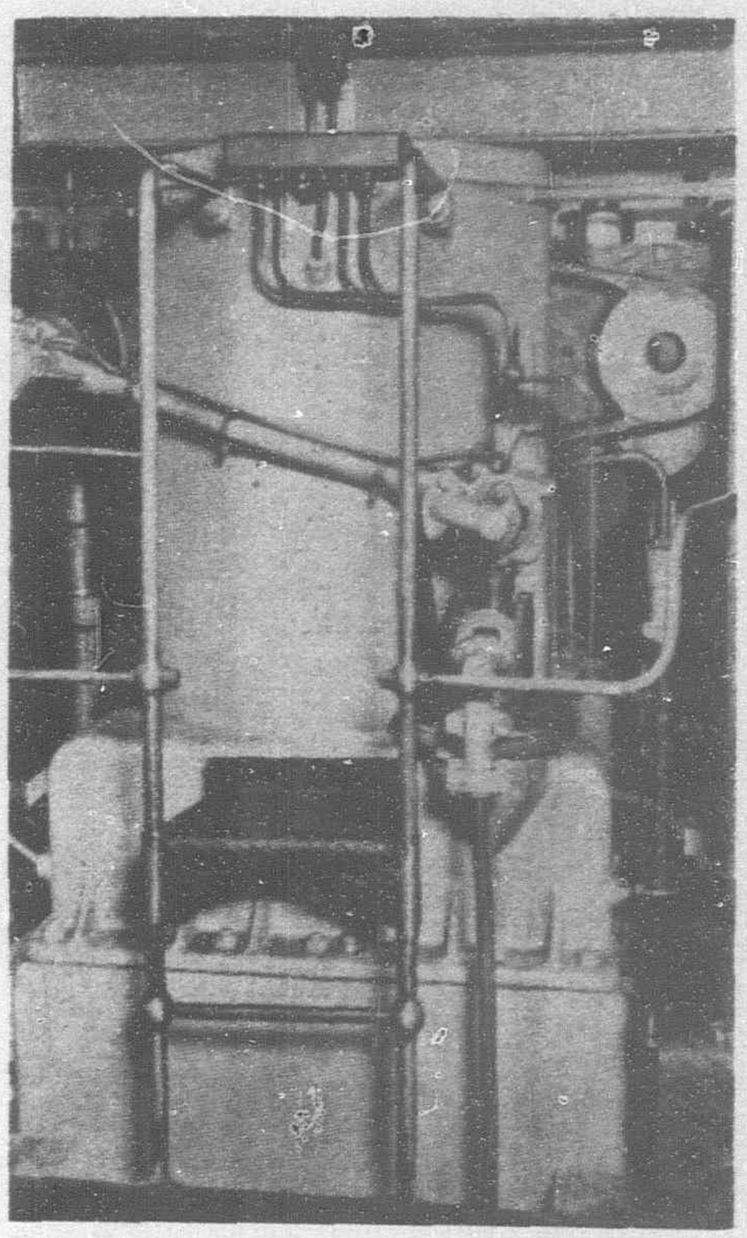
The "Silverpalm" proceeding on trials. She is to Maintain 14½ knots when fully loaded



One of the control stations at the forward end



Control station of the port engine. A is the wheel for the starting air and fuel supply, B. the reversing lever, and C the fuel-pump regulating wheel



Top of one cylinder, showing rocking pipe for piston cooling

is located immediately below the insulated holds, between the shaft tunnels.

Fire-detecting apparatus is provided and on the bridge is a cabinet containing the detectors for the poop, No. 4 upper 'tween deck, No. 1 lower 'tween deck, No. 2 hold, No. 3 upper 'tween deck, No. 1 upper deck and hold, No. 5 hold, and upper 'tween deck, and No. 2 lower and upper 'tween decks, making 11 separate orifices. The system is the Lux Rich.

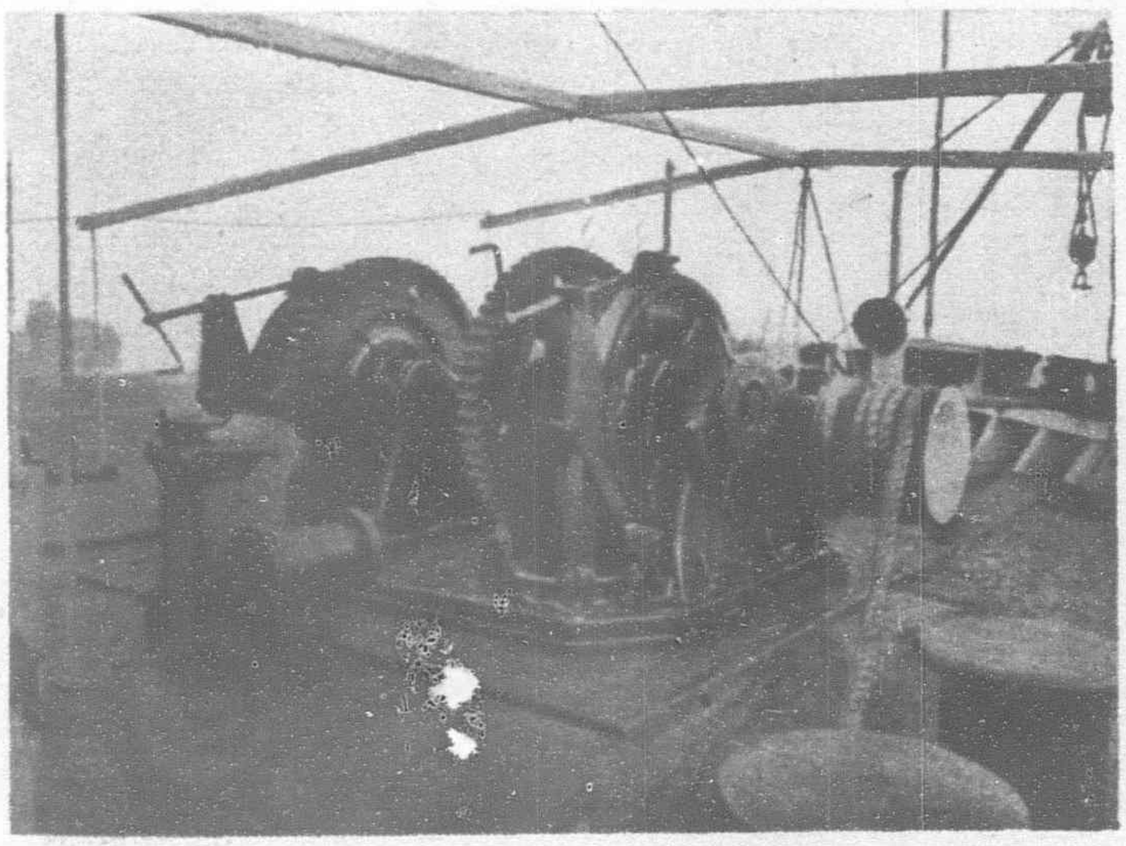
In addition to the main refrigerating spaces, there are ship's provision rooms for cold storage and a separate refrigerating machine is on the port side of the upper deck. The plant is of the Liverpool Refrigeration Co.'s ammonia type, the 3-in. compressor being driven by a 5 h.p. shunt-wound motor.

Main Refrigerating Plant

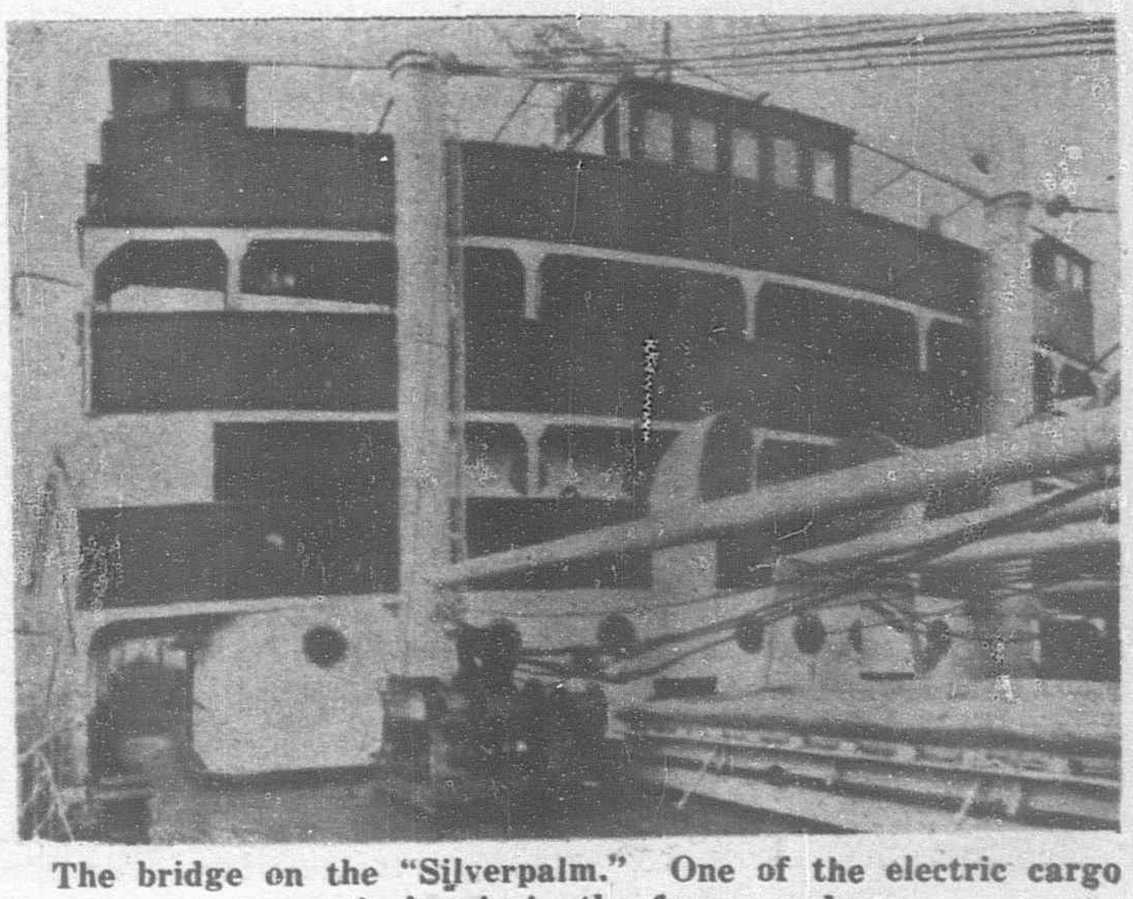
For the purpose of cooling the main cargo holds, which, as we have indicated, comprise 56,000 cubic ft. of insulated space, there are two of the Liverpool Refrigeration Co.'s ammonia machines, each having a two-cylinder compressor. The drive is taken from a 50 b.h.p. Sunderland Forge 220-volt compound-wound motor in each case, the speed being 340-500 r.p.m. These machines are directly coupled.

The steering gear is of the Hastie Hele-Shaw electro-hydraulic type having four rams athwartships. There are two motors, each of 23 h.p., shunt-wound and driving the pumps at 625 r.p.m. The pump delivery pressure to the rams is 1,500 lb. per sq. in. McTaggart Scott telemotor gear provides the means of control from the bridge. On deck aft is a warping winch with port and starboard drums on an extended shaft. A 33 h.p. motor provides the drive through a worm and worm wheel, the motor speed being 275 r.p.m.

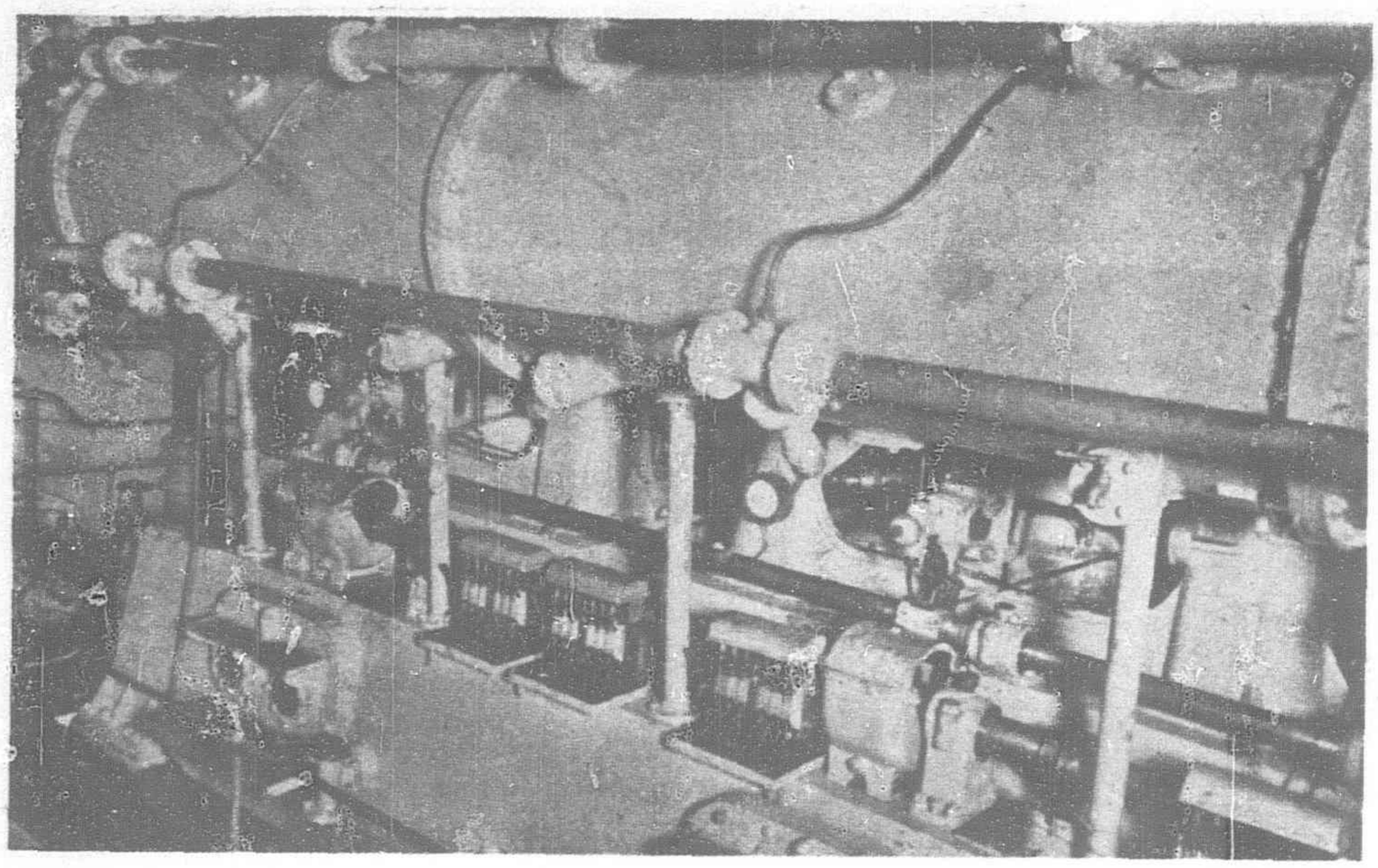
A Wilson anchor windlass is provided. The motor, below the forecastle deck, is a 60 h.p. machine running at 500 r.p.m., spur-reduction gears taking the drive to a vertical shaft. All the cargo winches are driven by Sunderland Forge electric motors of the same power and speed. There are 12 winches (apart from the warping winch), four being located aft, two amidships and six forward. The motors are rated at 33 h.p. and run at a maximum



The electrically driven anchor windlass, The driving motor is located below deck



The bridge on the "Silverpalm." One of the electric cargo winches is in the foreground



The back camshaft of one engine, showing two fuel valves and some of the mechanical lubricators

speed of 275 r.p.m. Seven derricks aft have a 5-ton lift apiece, two amidships are of the same capacity, while of the seven derricks forward one is capable of lifting 10 tons and the remainder are of five tons capacity.

Accommodation

Passenger accommodation is not provided, but there is a handsome suite of apartments for the owners or their guests. These rooms are below the captain's quarters; to starboard is a sleeping cabin with separate beds, a dressing table, chest of drawers, a roomy wardrobe and chairs. The furniture is mahogany, the wall panelling being finished in white enamel.

A door communicates with the sitting-room on the port side. In this apartment are a table and armchairs, together with a combined bookcase and writing desk, a settee being provided. The bathroom is on the starboard side, while opposite is a single bed-room with a chest of drawers, a wardrobe and a dressing table. The layout of these quarters is the acme of comfort and convenience.

The captain's quarters include a sitting-room to port, fitted with a writing desk, table, settee and bookcase. In the bedroom adjoining is a sleeping berth with drawers below, a chest of drawers being provided in addition; a wardrobe, settee and table are also to be found. Immediately aft is a spacious bath-room. The engineers' and electricians' cabins are on the port and starboard sides of the engine casing. Adjacent to the chief engineer's cabin is an office, while the engineer's mess-room is to starboard and contains two tables, revolving chairs, settees around and a side-board in mahogany, a pantry adjoining. The saloon below the owners' accommodation is furnished with two tables, armchairs, a settee and a sideboard. Quarters for the crew and the engineers' assistants are provided forward.

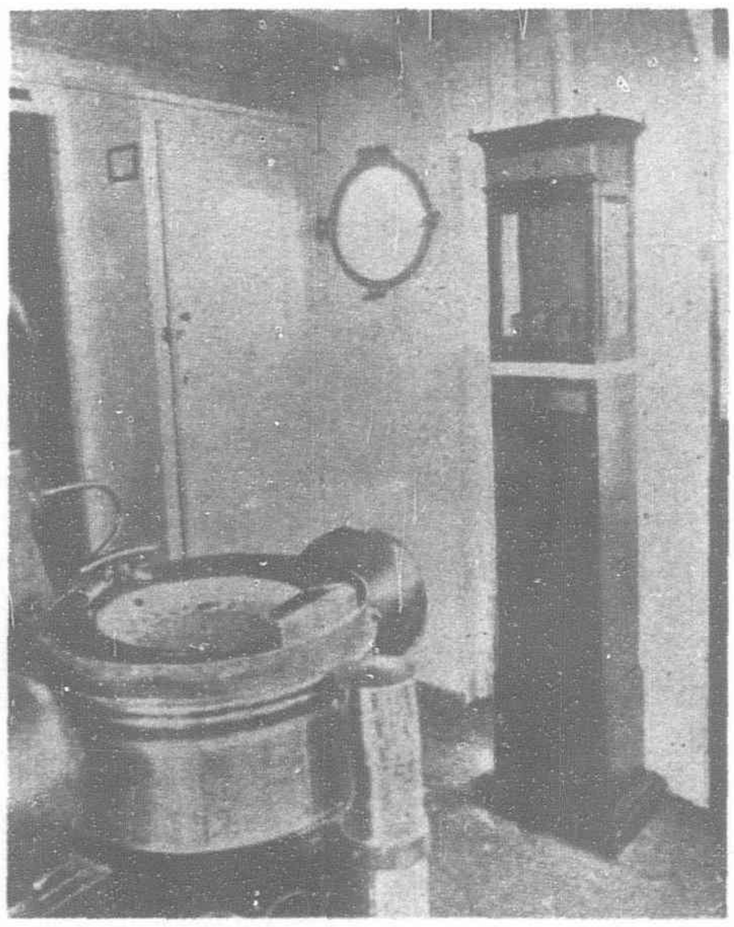
Tank Arrangements

All the double-bottom tanks, fore and after peaks, deep tanks and those for fuel at the sides of the tunnels are given in capacities of water-ballast, calculated at 35 cubic ft. per ton, and are therefore subject to modification according to the circumstances. No. 1 double-bottom tank has a capacity of 137 tons, No. 2 holds 344 tons, No. 3a 137 tons, No. 3, 191 tons, No. 4, 368 tons, No. 5, 287 tons, No. 6, 64 tons, the after peak 421 tons and the fore peak 259 tons.

The side tanks aft have a combined capacity of 531 tons, while of the deep tanks that forming No. 3 hold carries 1,126 tons, No. 4 hold having a capacity of 1,105 tons. There are three freshwater tanks on the second deck, the total capacity being 50 tons.

The waste-heat boiler to which we have referred is of the Clarkson thimble-tube type. It takes the exhaust gas from the four auxiliary engines only, the main-engine exhaust pipes being led directly to the funnel. The boiler, which is fitted with a Thermofeed regulator, has a diameter of 2 ft. 9 ins. and an overall height, including the combustion chamber, of 8 ft. 3½ ins. No oil-burning installation is provided. Having 100 sq. ft. of heating surface, the capacity is between 500 lb. and 560 lb. of steam per hour, the working pressure being 100 lb. per sq. in.

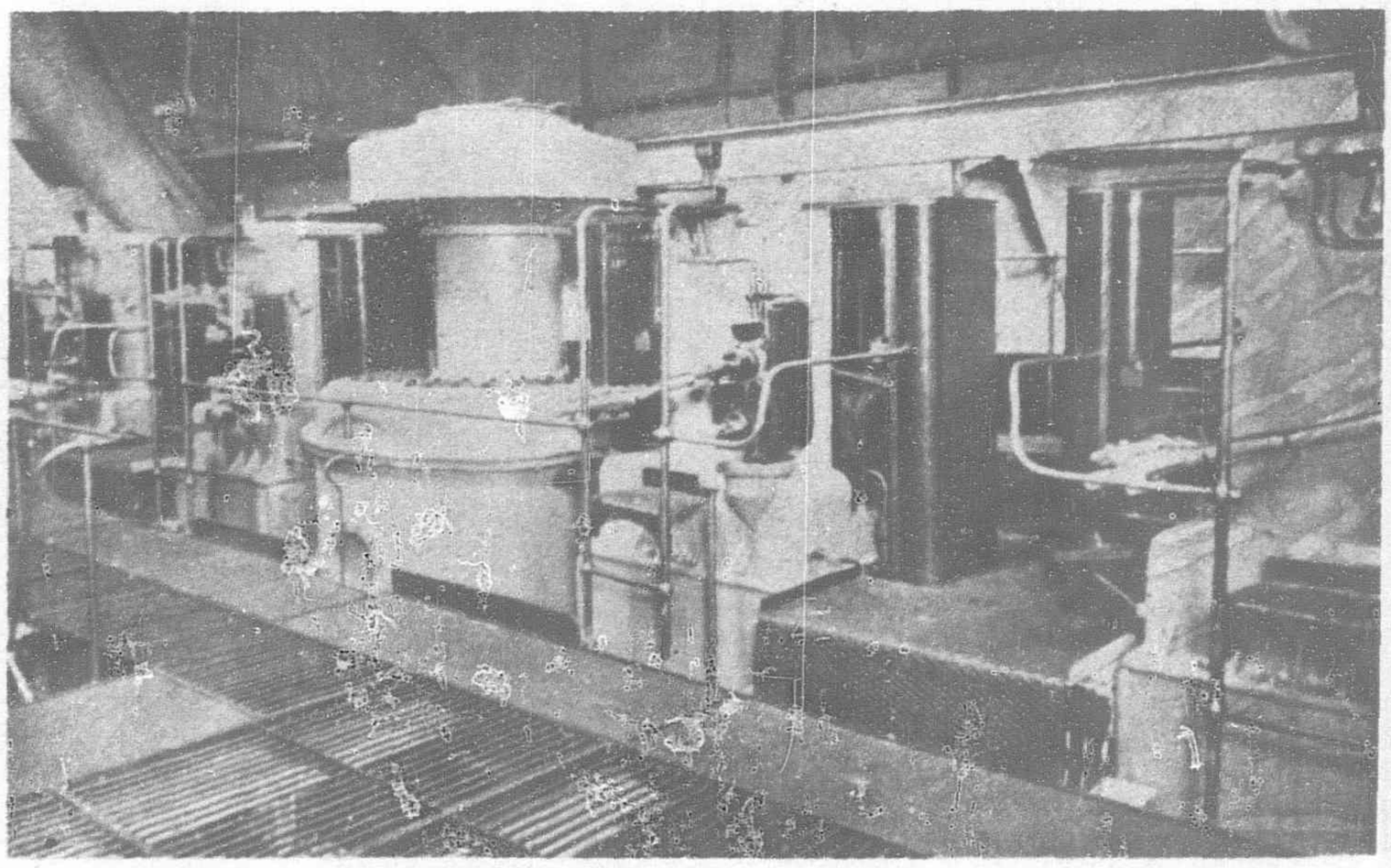
In addition, there is a Cochran oil-fired boiler below, on the starboard side of the engine-room. This boiler is 7 ft. 6 ins. in diameter, the height being 18 ft. 9 ins. A White low-pressure oil-burning installation is fitted. The working pressure is 150 lb. per sq. in., and a 6-in. by 4-in. by 7-in. Weir feed pump is provided. Aft, amidships, are three Sharples enclosed-type purifiers, each with a capacity of 300 gallons per hour. The drive is provided by a 2.5 h.p. motor running at 3,500 r.p.m.



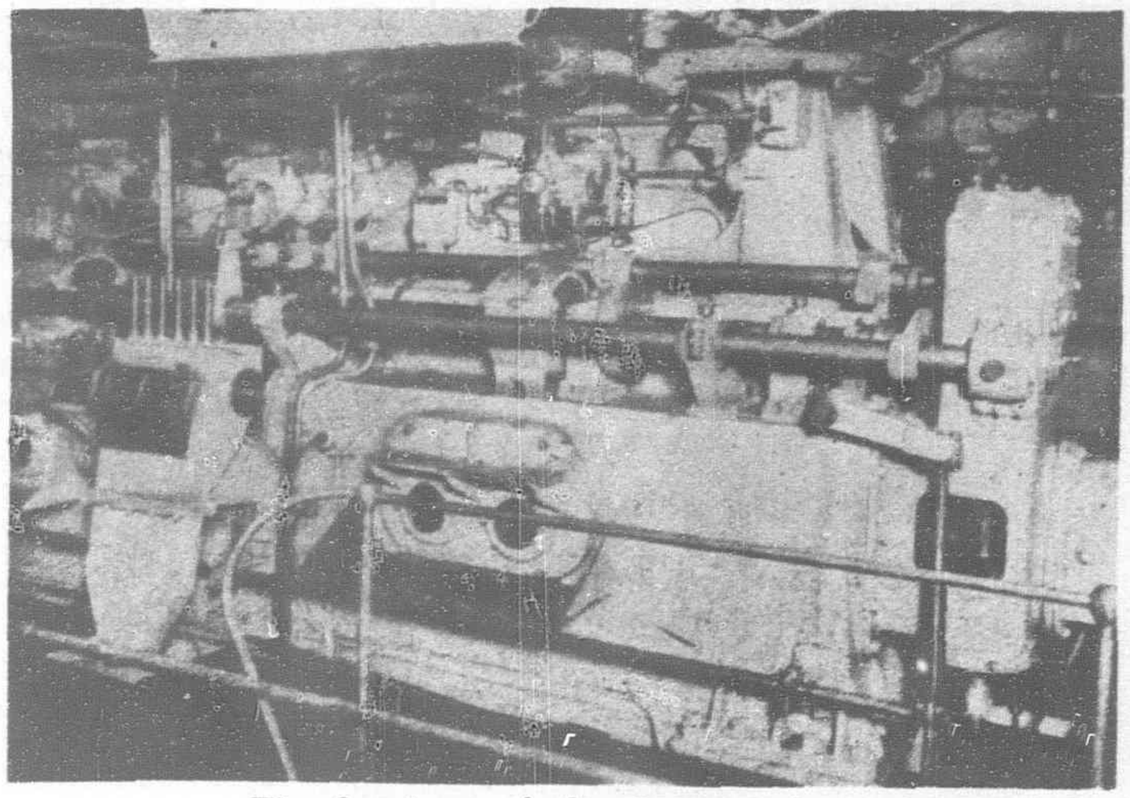
Fire-detecting cabinet on the bridge

Engine-room Auxiliary Machinery

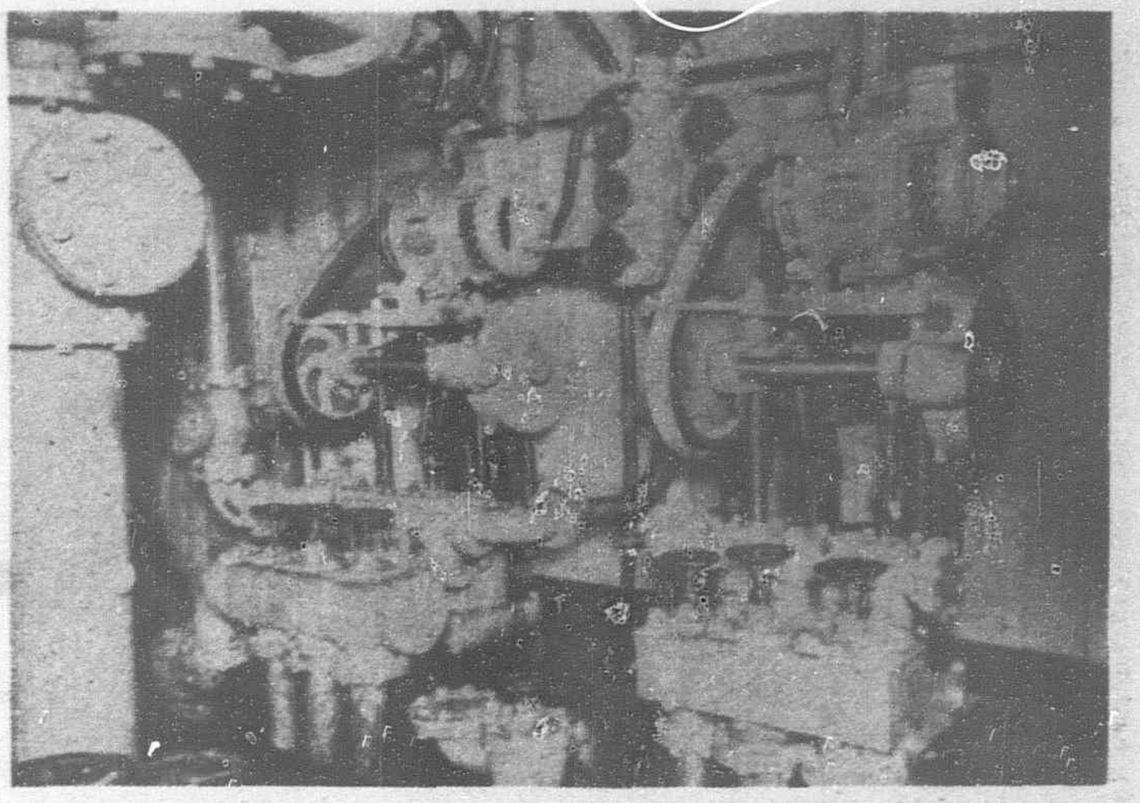
Three large starting air containers are located at the port side of the engine-room, forward, adjacent being two three-stage Weir air compressors. One has a capacity of 100 cubic ft. per minute, the pressure being 600 lb. per sq. in., while the other has double the output of the smaller machine, the pressure being the same. Each compressor is design-



Top of one main engine, showing the upper part of the scavenging pump



The front camshaft of one main engine



Two of the chain-driven pumps in the engine-room

ed to run at 350 r.p.m., and is driven by an electric motor, one of 44 h.p. and the other of 67 h.p.

Current for lighting and power is provided by four Allen-B. and W. three-cylinder-engined Sunderland Forge compound-wound dynamos. The output of each machine is 100 kw. at 220 volts, and the engines are rated at 150 b.h.p., the speed being 300 r.p.m. The cylinder diameter is 325 mm. and the piston stroke 370 mm. At the back of the port machines is a standby electrically driven circulating water pump. Aft on the starboard side is a 7-in. by 7-in. Weir fuel oil transfer pump with a capacity of 50 tons per hour. It is driven by means of a chain from a 7 h.p. motor running at 900 r.p.m.

Chain drive is a distinguishing feature of the reciprocating pump installation throughout, the absence of noisy spur-reduction gearing being a commendable feature. When we add that the main engines are all but silent in operation (even at the top it is practically impossible to detect any noise from the suction to the main scavenging air pumps, while sounds of mechanical apparatus above the camshafts are virtually incapable of detection) the conditions in the engine-room of the *Silverpalm* will be appreciated. We do not suggest that noise is absent below, for in any case the valve motion of four-stroke auxiliary engines is always audible, but it is clear that the whole problem has received a commendable degree of attention.

Pumping Equipment

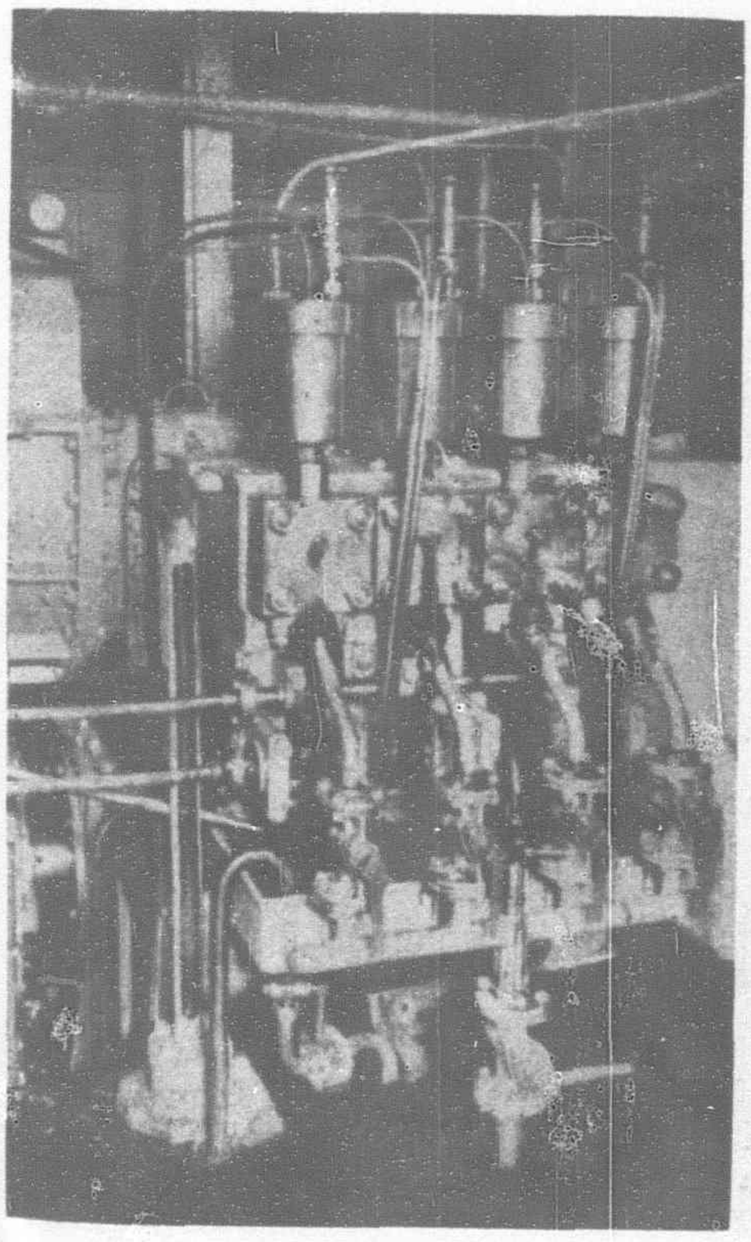
There are two 6-in. by 6-in. chain-driven pumps on the starboard side of the engine-room, each of the same capacity, namely, 40 tons per hour. One is a bilge pump and the other a general service unit and the drive is furnished by a 7 h.p. motor running at 900 r.p.m. Forward of these is a 15-ton evaporator. Amidships at the forward end is the auxiliary high-pressure fuel oil pump unit, the four plungers being driven by an electric motor.

Between the main engines are two Drysdale upright-type fresh-water jacket-cooling pumps, each having a capacity of 275 tons per hour. They are driven by 37-40 h.p. motors, the speed being 1,050-1,450 r.p.m. Aft of these are the forced lubricating oil pumps, which are of the plunger-type, chain-driven, and each has a capacity of 55 tons hourly. Between these pumps is arranged an Autoklean strainer. The Drysdale salt-water pump is forward and is coupled to a 37-40 h.p. motor running at 1,050-1,450 r.p.m. The ballast pump on the starboard side has a capacity of 300-tons per hour, and is driven by a motor of the same power and speed.

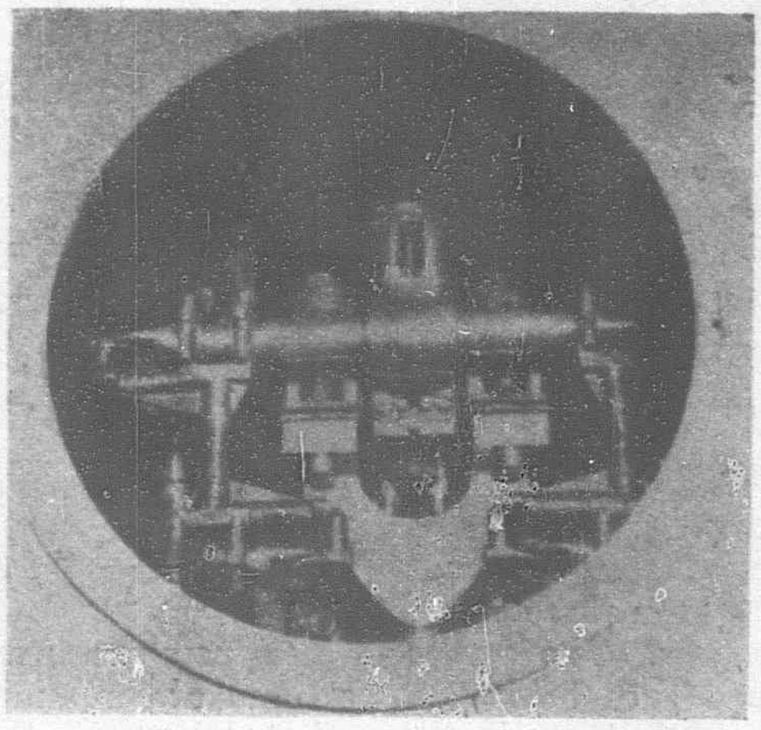
Forward of the Sharples centrifugal separators is a purified oil tank, together with a Stothert and Pitt electrically driven pump having a capacity of two tons per hour. The emergency set consists of a two-cylinder Parsons petrol-paraffin engine coupled to a 6 kw. Sunderland Forge dynamo, the speed being 1,000 r.p.m. This engine is also arranged to drive a small Reavell standby air compressor, a sliding pinion being provided to engage or disconnect the machine. The main switchboard is adjacent. At the top of the engine-room is a Morris 6-ton electric crane.

The Main Engines

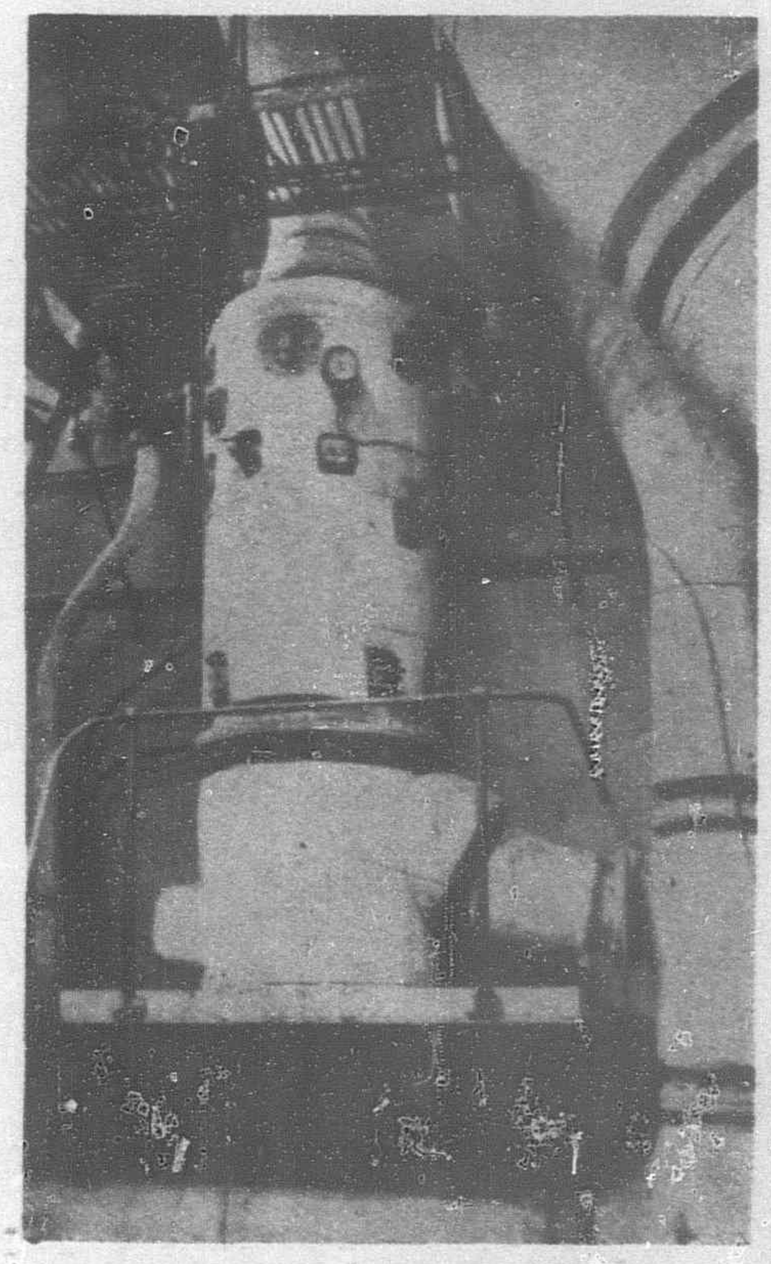
The dimensions and certain other details of the main engines have already been made apparent and an extended description of these units is unnecessary.



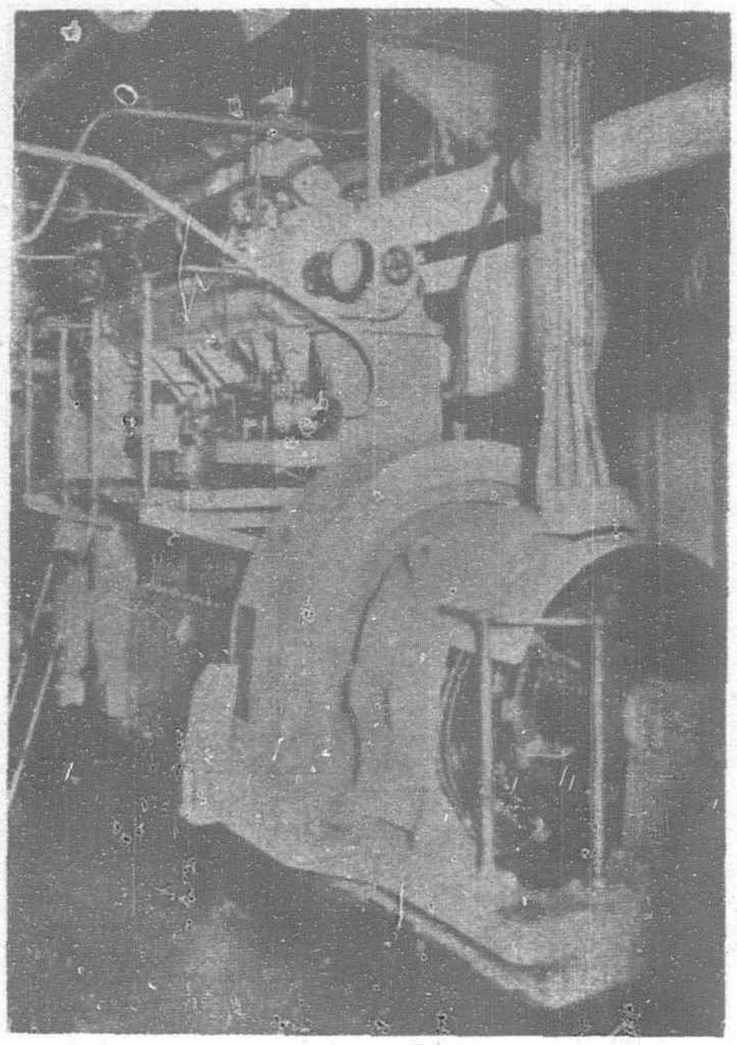
Main high-pressure fuel pumps



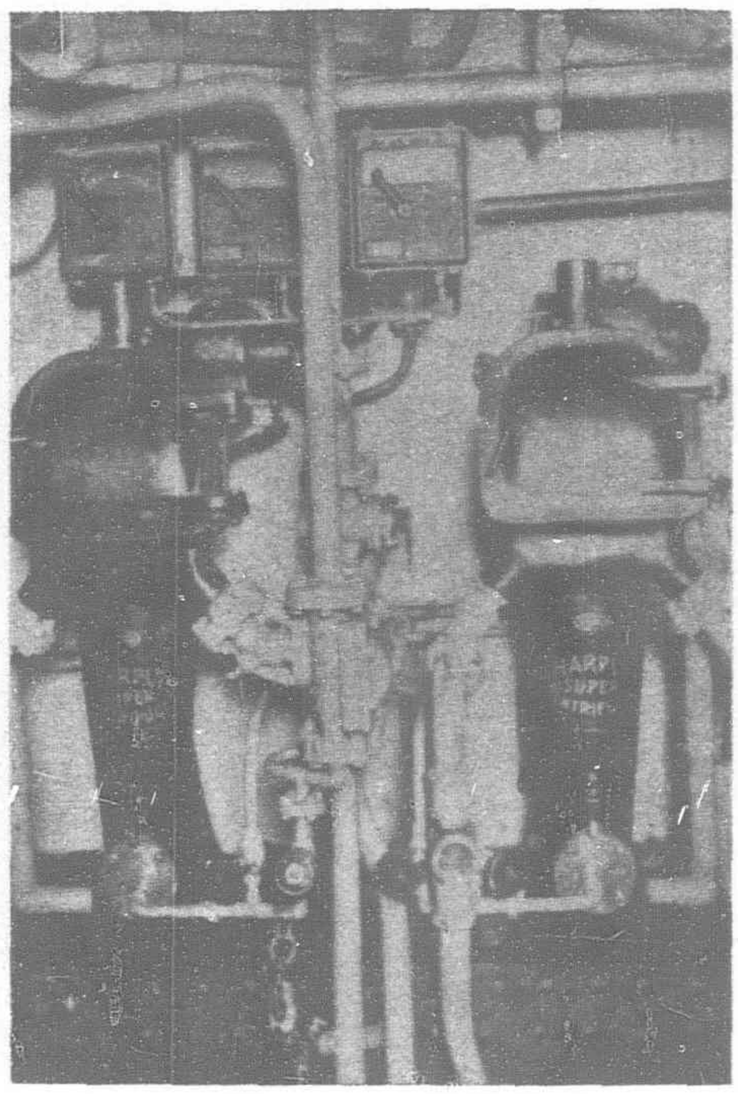
One of the main engine crossheads seen through the aperture for a crank-case door



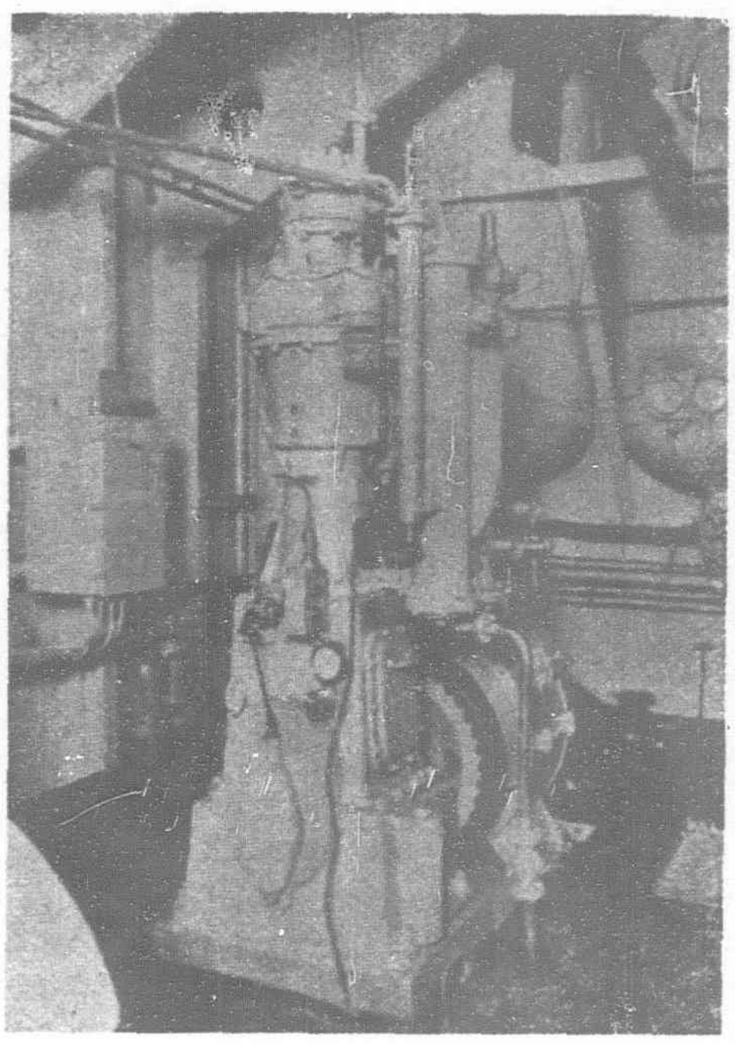
The Clarkson waste-heat boiler



One of the Allen-engined 100 kw. dynamos



Two of the centrifugal purifiers



A Weir electrically driven air compressor

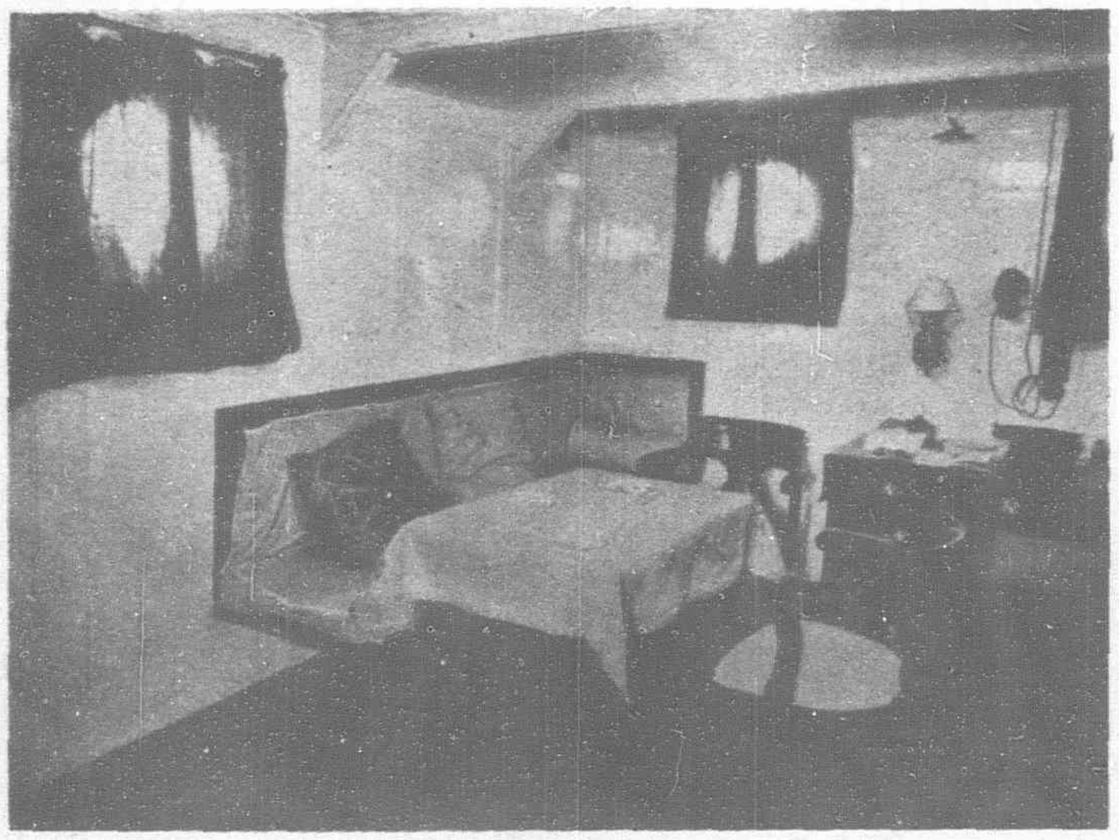
The controls comprise the usual handwheel for placing the engine on air and fuel as required, a lever being fitted for moving the camshaft fore and aft when reversing. No servo motor is employed, this being a feature of all Doxford engines of the highest powers hitherto constructed.

There is a small handwheel for fuel regulation and a lever for admitting air to the engine. Beyond a mercury gauge for the scavenging air pressure, and the usual gauge board above, there are no additional fittings of importance at the manœuvring platform. The camshaft drive, taken through a single vertical shaft, is aft and a cross-shaft operates the back and front camshafts. The shaft at the back drives nine sets of mechanically operated lubricators, each with six points of delivery, cams being provided for the operation of the back fuel valves. The front shaft operates the air-starting valves in addition to the fuel valves.

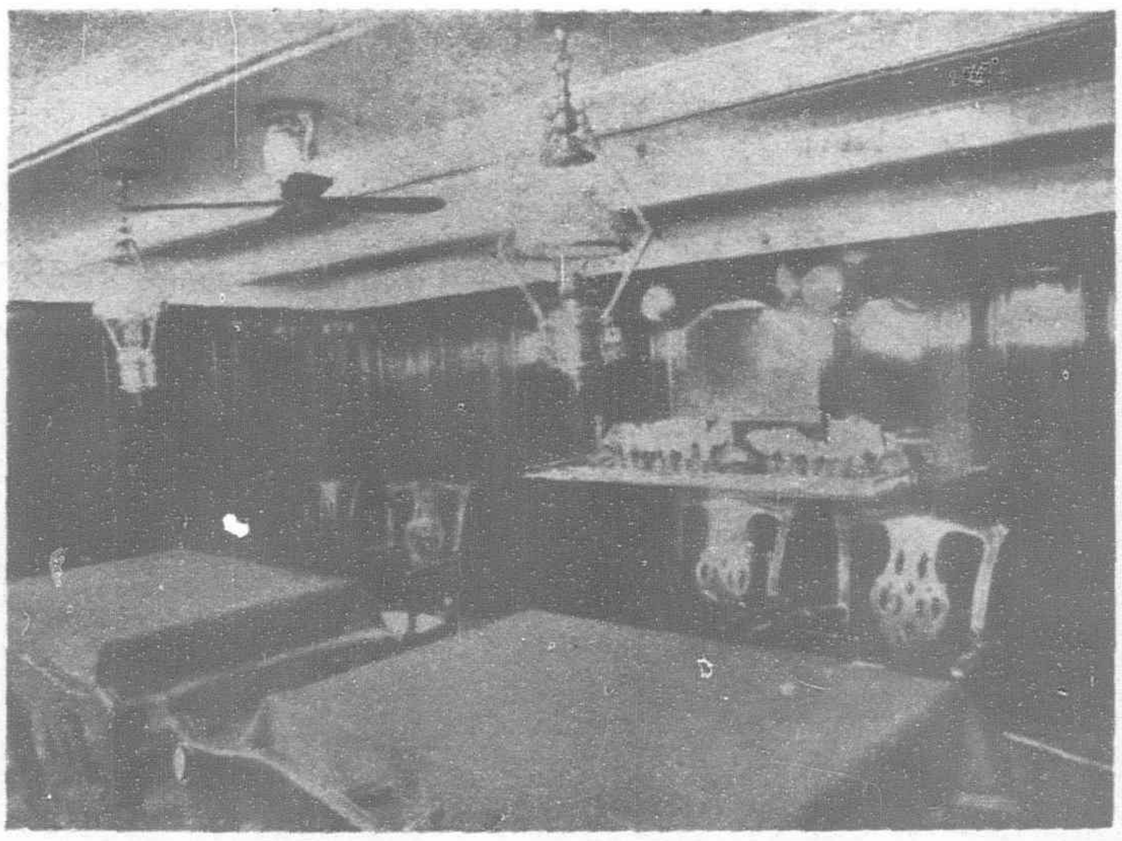
On the same level are the discharge observation troughs for the piston and jacket cooling-water outlets. The air-starting, relief and the front and back fuel valves have a separate cooling circuit and observation troughs are provided to note the flow of water, as in the case of the larger outlets for the pistons and jackets. The double-acting reciprocating pumps for the scavenging air are driven from cranks on the main shafts, and are located between Nos. 2 and 3 cylinders.

Of the other six ships under construction two are being built by J. L. Thompson and Sons, and will be equipped with Richardsons, Westgarth-Doxford engines. They will be similar in all respects to the *Silverpalm*.

The remaining four are being constructed by Harland and Wolff.



A view of the Captain's sitting-room



Part of the dining saloon

New P. & O. Liners for Far Eastern Service

Details are now officially available of the two steamers to be built for the P. & O. Company's Straits-China-Japan mail and passenger service, for which orders have recently been placed with Messrs. Alexander Stephen & Sons, Ltd., of Glasgow. The vessels will be of 14,500 tons gross measurement, the length being 520 feet and the beam 70 feet, and they will have a 30 feet maximum draft.

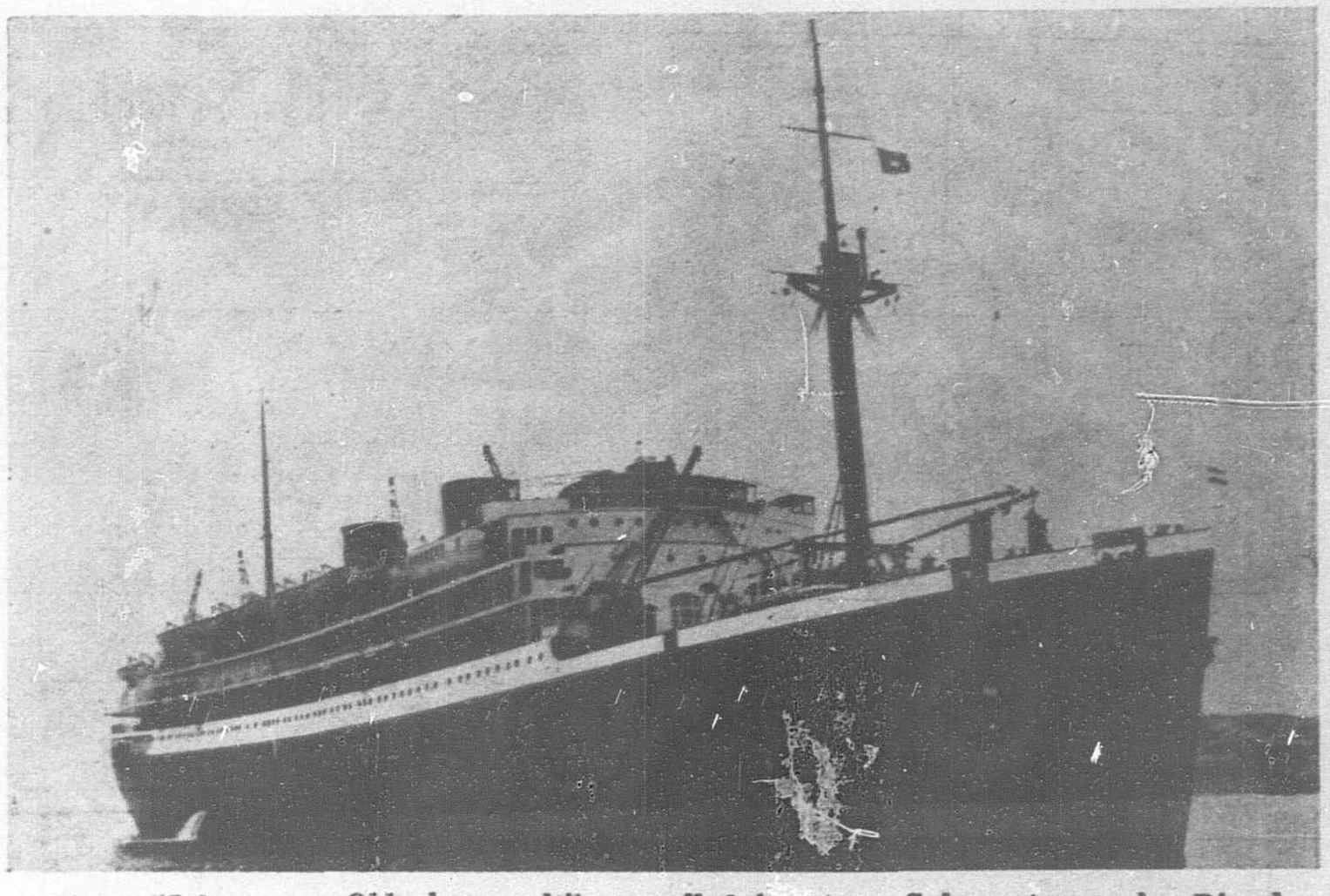
The new ships will be driven by single-reduction geared turbines of 14,000 h.p., with steam from high-pressure water-tube boilers. It is expected that the earlier one will be completed on August, 1931, and the other in the following October.

New Shipping Line for Pacific

A new passenger and freight transport line will get under way on and after January 1 by virtue of an amalgamation recently effected between the Java Pacific Line and the Silver Line.

The proposed new steamship service will be operated between Los Angeles and Sourabaya *via* San Francisco, Portland, Seattle and Vancouver.—*Rengo.*

Refrigerating Plant of the New Diesel-Engined Passenger Liner "Johan van Oldenbarnevelt" of the Stoomvaart Maatschappij Nederland, Amsterdam



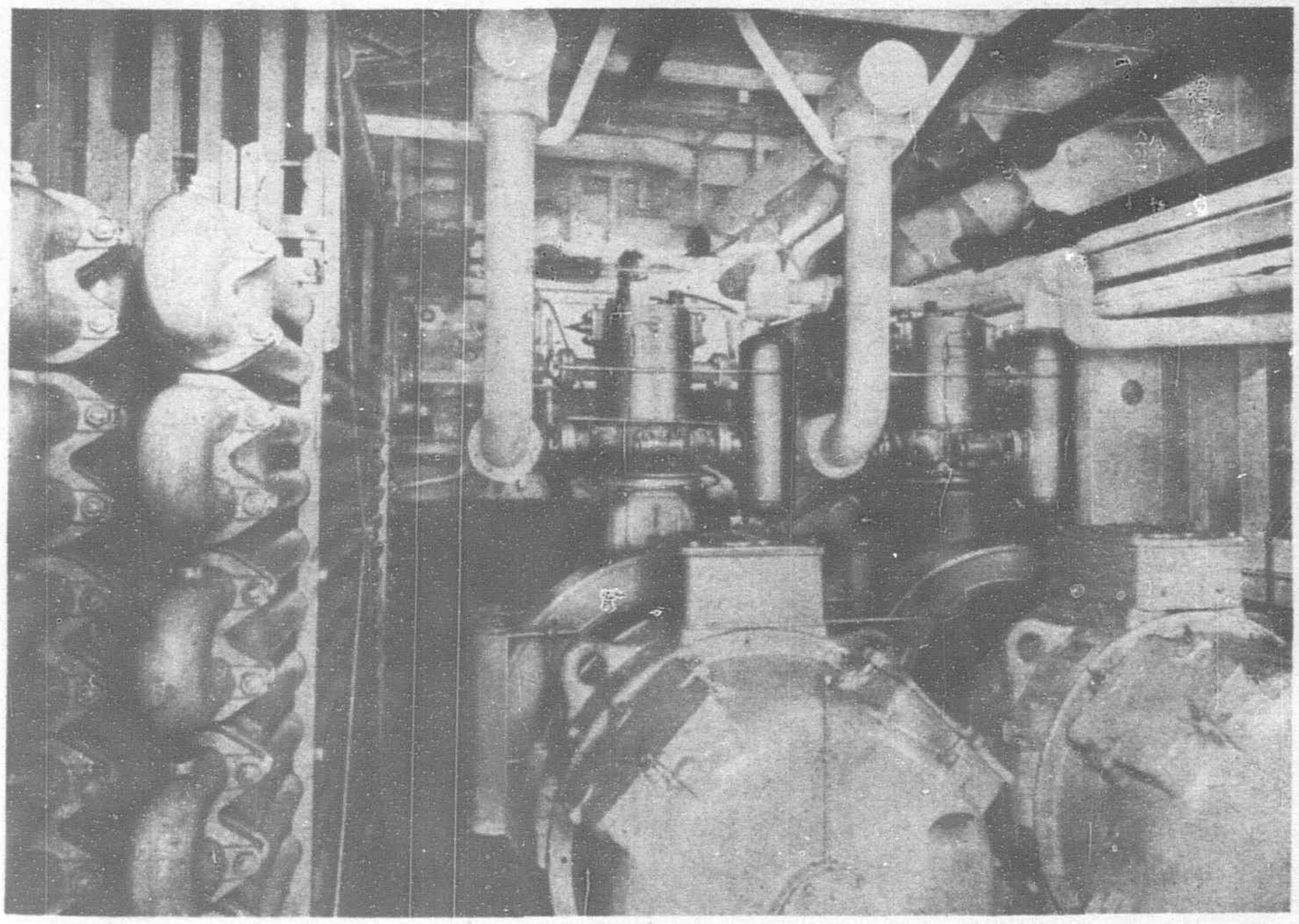
Liner "Johan van Oldenbarnevelt" propelled by two Sulzer two-cycle Diesel engines developing 14,000 b.h.p. at 100 revs. per min. and equipped with a Sulzer refrigerating plant

A LARGE passenger ship, which will vie with first-class hotels as regards comfort, must be equipped with the most up-to-date machinery and apparatus for preserving stores, particularly provisions intended for use in the catering department. The arrangement and size of the refrigerating plant depend in the first place on the route on which the ship is in service and also on the possibility of acquiring new stocks of provisions at intermediate ports. The Stoomvaart Maatschappij Nederland maintains a service between Amsterdam and the Dutch East Indies *via* Genoa and the Suez Canal. The routes taken by the ships are amongst those in which the highest temperatures are found; the water in the Red Sea, for example, reaches temperatures of about 95° F. Also it is quite impossible to replenish the stock of certain provisions during the course of a voyage, so that it is absolutely necessary to ship them in sufficient quantities for the journey out and home at the port of departure.

These circumstances give quite a special character to the refrigerating plant of the *Johan van Oldenbarnevelt*, both as regards the diversity of the rooms to be cooled and also the difficult working conditions to which the refrigerating machines are submitted in tropical regions. In addition to that, it should be mentioned that the cold rooms on this ship have been constructed sufficiently large to carry refrigerated goods to the colonies or from the colonies to the home country, in addition to provisions for use on board.

There are 19 cold rooms and cold cupboards with a total capacity of 19,000 cub. ft. In addition to that, there are also a plant for cooling drinking water, a central air cooler (thermo tank) and an ice-making plant. These various plants are located on three 'tween decks situated one above the other, Fig. 2, and some of them are comparatively remote from the compressor room, which lies in the lowest part of the ship, near the other auxiliary machinery.

The cold required for the various apparatus and plants is supplied by a Sulzer ammonia compressor rated at 240,000 B. Th. U. per hour when working with an evaporating temperature of +5° F. and a condensing temperature of 115° F., and, according to the rules of the Bureau Veritas, is in service 18 hours daily. A second Sulzer compressor with its condenser serves as stand-by.



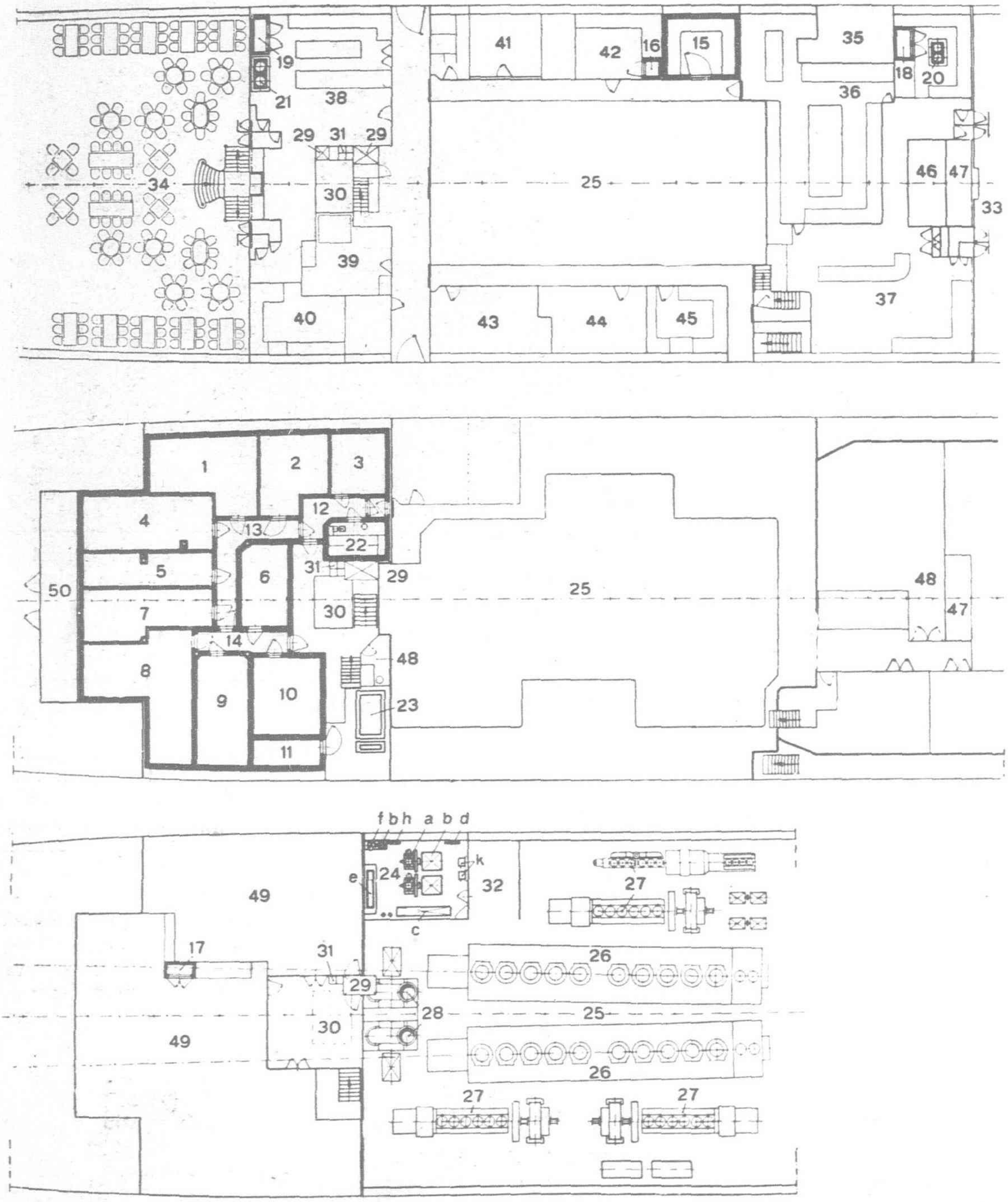
Compressor room on the M.S. "Johan van Oldenbarnevelt" with two-stage Sulzer Compound Ammonia Compressors, each rated at 240,000 B.Th.U. per hour

In consequence of the great advantages possessed by ammonia refrigerating machines for work in the tropics, most of the ships belonging to the Nederland Company are fitted with this system, which has proved very good and is therefore being more and more adopted for marine work.

All the cold rooms, ante-chambers, ice tank, and central air cooler are cooled by direct injection of ammonia into the cooling coils, which are made of seamless drawn steel tubes.

The compressors draw in dry ammonia gas (working with superheat). The cooling coils of the various rooms are each provided with a small liquid separator, whilst the suction pipes lead from the rooms into a central liquid separator, from which the gas is drawn by the compressor.

Each cold room is connected to a system of air ducts, leading from the central air cooler. The refrigerating capacity of any room can thereby be raised if necessary, for example when provisions which have been brought uncooled into the cold rooms have to be frozen quickly, and also to renew the air in the cold rooms when desired. The central air cooler is capable of delivering 175,000 cub. ft. of air per hour, cooled to +14° F; the cooled air is circulated by means of a high-pressure fan.



Deck plans of the liner "Johan van Oldenbarnevelt"

Cold Rooms	Temperature deg. F.	Floor space sq. ft.	Contents cub. ft.
(1) Fruit	37.5	314	2,180
(2) Milk	37.5	205	1,480
(3) Meat thawing ..	43	135	990
(4) Eggs	32	224	1,800
(5) Fish	20	180	1,250
(6) Cargo I	34-20	154	1,250
(7) Meat I	20	246	1,710
(8) Meat II	20	385	2,700
(9) Cargo II ..	34-20	236	1,625
(10) Cargo III ..	34-20	212	1,525
(11) Ice	28.5	75	535
(12) Ante-room I ..	32	65	460
(13) Ante-room II ..	28.5	133	920
(14) Ante-room III ..	28.5	81	565
(15) Cold meat stores	37.5	188	1,500
(16) Cold meat cupboard	35.5		64
(17) Cold wine cupboard	41		64
(18) Cold pantry cupboard, 1st class	39		127
(19) Cold pantry cupboard, 2nd class	39		127

(20) Drinking water cooler, 1st class
(21) Drinking water cooler, 2nd class
(22) Thermo tank
(23) Ice tank, 220 lb. per day
(24) Compressor compartment.
- (*a*) Compressors
- (*b*) Electric motors for compressors
- (*c*) Condensers
- (*d*) Brine distributor
- (*e*) Brine cooler
- (*f*) Brine pumps
- (*g*) Electric motor for brine pumps
- (*h*) Ammonia regulating station
- (*k*) Starting switches

(25) Main engine room
(26) Two main engines, 7,000 b.h.p. each, at 100 revs. per min.
(27) Auxiliary engines, 760 b.h.p. each, at 170 revs. per min. and 300 b.h.p. at 300 revs. per min.
(28) Two turbo blowers for scavenging air for the main engines
(29) Lift.
(30) Provision hatch
(31) Ventilation shaft
(32) Workshops
(33) Dining saloon, 1st class
(34) Dining saloon, 2nd class
(35) Cook's scullery
(36) Galley
(37) Pantry, 1st class
(38) Pantry, 2nd class
(39) Bakery
(40) Pantry, 2nd class
(41) Stewards mess
(42) Butcher's
(43) Confectionery
(44) Stewards mess
(45) Pantry scullery
(46) Luggage hatch
(47) Funnel shaft
(48) Luggage, mails, etc.
(49) Provisions and drinking water

The central air cooler is put into action when provisions are first brought into the cold rooms, and also at intermediate ports when fresh provisions are taken on board.

The cold cupboards and cold rooms for meat, and also the apparatus for cooling drinking water, are cooled with brine.

The refrigerating plant installed in the engine room, Fig. 2a, consists of :

Two compound ammonia compressors (Figs. 5, 6 and 7) working with superheat, of which one alone is capable of maintaining the whole service. They are vertical machines with differential piston, the two compression stages being in one cylinder. Each machine has an intermediate receiver fitted with a coil for cooling the ammonia delivered from the low-pressure stage. When passing through the hot waters of tropical regions, it is possible with this arrangement to obtain particularly favorable working conditions. The following are the principal data of each of the compressors :

Rated capacity 240,000 B. Th. U. per hour ;

Speed adjustable between 160 and 320 revs. per min ;

Power required for the given working conditions 25 to 44 h.p.;

Direct coupled D. C. motors, 28 to 55 h.p.

Each compressor set is erected on an extremely robust cast-iron bedplate, which serves at the same time as lubricating oil container.

A flywheel mounted on the crankshaft and provided with counterweights ensures the machine running uniformly and free from vibration in spite of the great variations in speed.

The compressors have very light spring disc valves, and the stuffing-box for the piston is fitted with metallic packing. The effective lubrication of all parts is ensured by an automatic central forced lubricating apparatus.

The plant in question is a typical example of how the adoption of the compound arrangement enables particularly suitable compressors to be designed for marine work. Compound compressors not only take up the smallest possible space at the position available for them, but their design also makes the principal parts very easily accessible. In spite of the presence of *crossheads*, which are essential for accurate running and for the overhaul of the stuffing-box, the headroom required by the machine is extremely low and the manipulation of the suction and delivery valves simple and easy to carry out.

Because of the compresion being in two stages, the stresses on the valves and packing rings are reduced to one half, thus favorably influencing the life of these parts, which are essential for the efficient working of the compressor, and the reliability of the whole refrigerating installation.

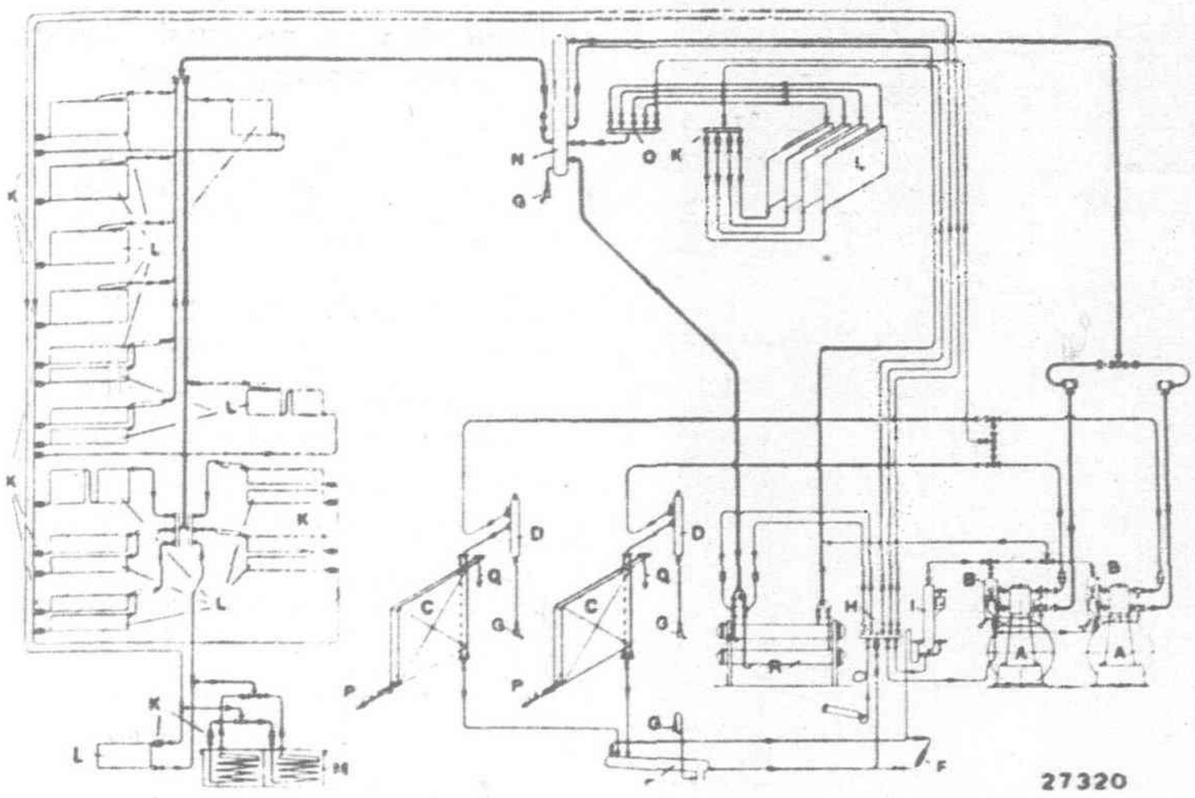
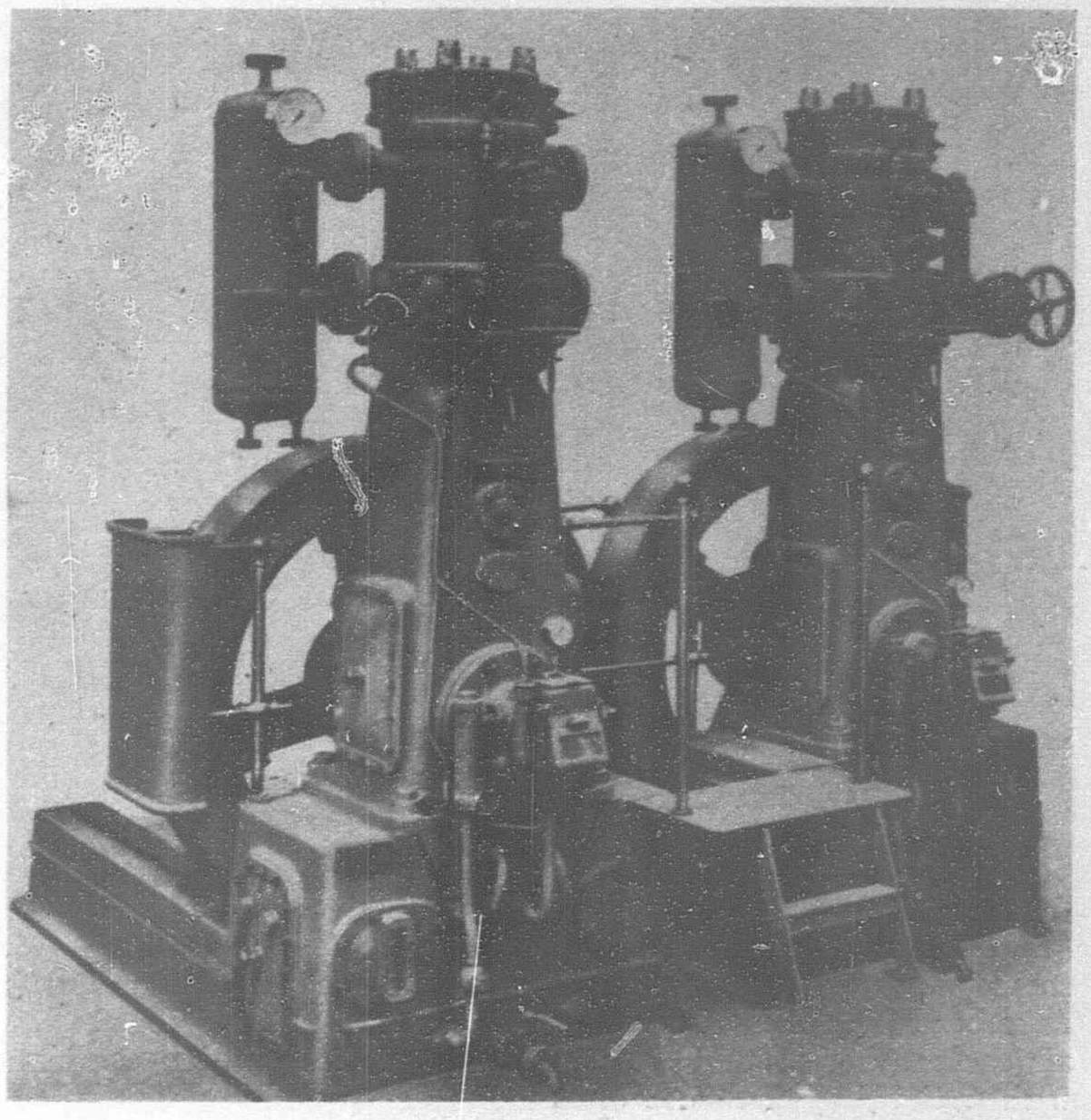


Diagram of refrigerating installation in the Suizer-engined Motorship "Johan van Oldenbarnevelt"

(*a*) Compressors
(*b*) Receivers
(*c*) Double-tube condensers
(*d*) Oil separators
(*e*) Ammonia storage bottle
(*f*) Liquid-level indicator
(*g*) Oil drain cocks
(*h*) Primary regulating station
(*i*) Air purgers
(*k*) Secondary regulating stations
(*l*) Air coolers
(*m*) Ice tank
(*n*) Liquid separator
(*o*) Thawing off station
(*p*) Cooling-water inlet
(*q*) Cooling-water outlet
(*r*) Brine cooler



Vertical compound Ammonia Compressors for direct coupling to electric motors

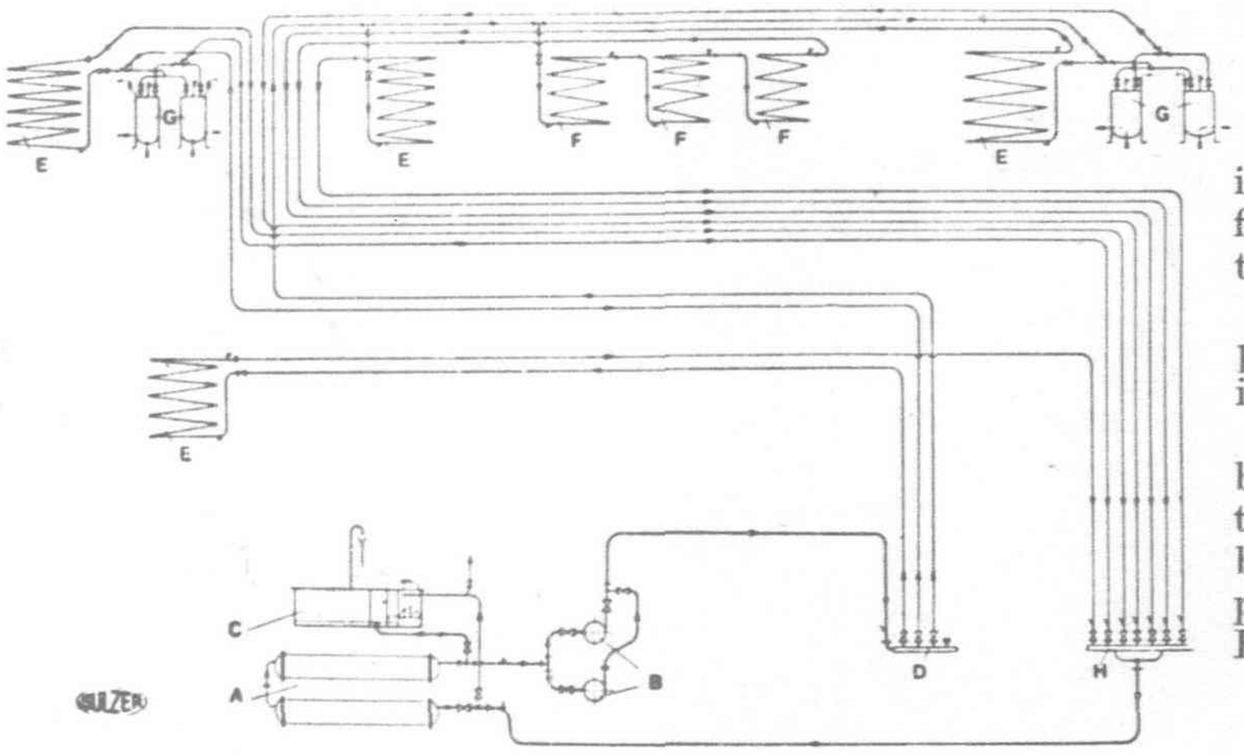


Diagram of brine piping in the refrigerating plant of the Sulzer-engined motorship "Johan van Oldenbarnevelt"

(*a*) Brine cooler
(*b*) Brine pump
(*c*) Brine dissolver
(*d*) Distributing station
(*e*) Cold cupboard air coolers
(*f*) Air coolers for work-rooms
(*g*) Drinking water coolers
(*h*) Collecting station

This is one reason why Sulzer Brothers have adopted the compound compressor as standard type and now employ it in most of their plants.

Each compressor is connected to a counter-current condenser, fitted with double concentric tubes and cooled with sea water. In order to prevent corrosion, the surfaces of the tubes coming into contact with the sea-water are covered with copper. The upper part of the condensers serves for pre-cooling the superheated ammonia and is connected with the oil separator. In this manner very thorough separation of the oil is attained, and the apparatus has proved to work satisfactorily ever since the plant was put into service.

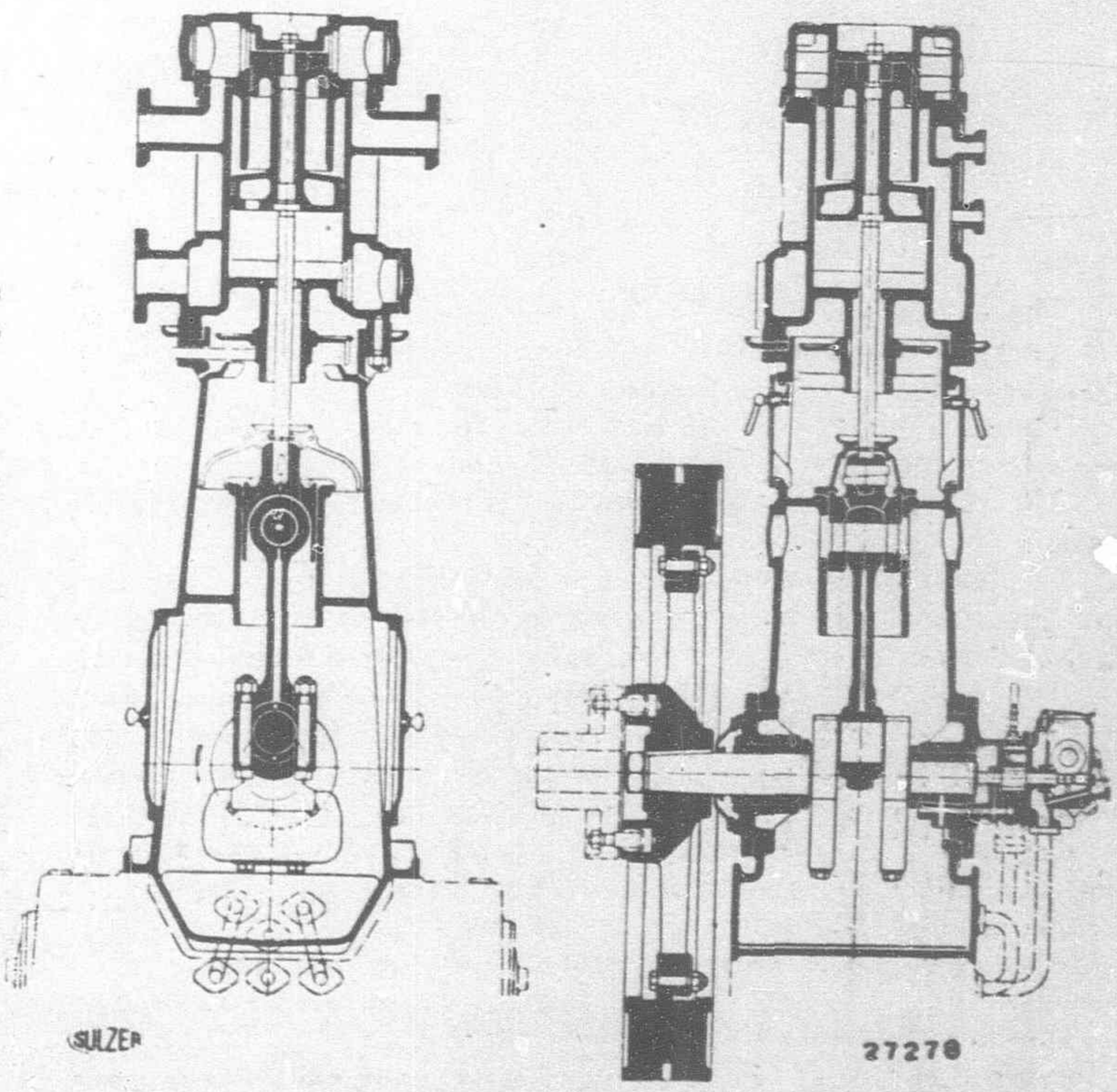
The liquefied ammonia flows into a central storage tank under the floor of the engine room and passes from there into the central ammonia regulating and distributing station situated near the compressors.

The brine cooler for the cold cupboards is fed partly with ammonia from the central liquid separator erected in the 'tween deck over the compressor room, and partly with ammonia injected directly from the central distributing station.

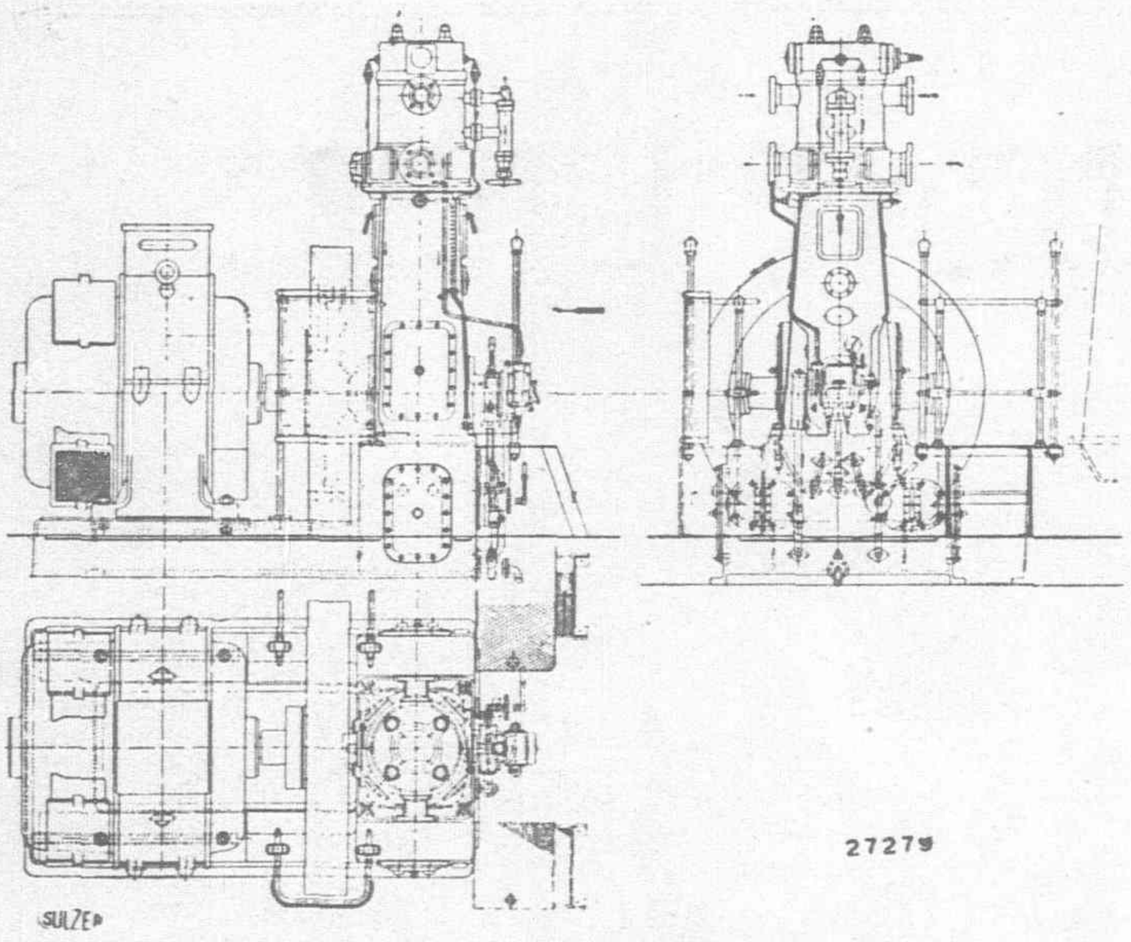
Two electrically-driven centrifugal pumps, one of which serves as stand-by, circulate the brine in the various pipes. The central brine distributing station is located in the compressor room ; it is combined with a collector into which the return brine pipes, fitted with thermometers, lead, thus allowing the brine circulation to be easily inspected.

The machinery is arranged in such a manner that the separate pieces of apparatus can easily be dismantled ; during overhauls it is not necessary to dismantle the main piping.

The ammonia distributing system (see diagram in Fig. 3) begins at the central distributing and regulating station beside the compressors. The station is fitted with a regulating valve, by means of which the service can be regulated, thermometers and pressure gauges being fitted on the compressors to facilitate control. Each group of evaporating coils in the cold rooms (two in the larger



Sections through Marine Compound ammonia compressor



Marine Compound Ammonia Compressor

rooms) is provided with a regulating valve located in the antechamber beside the entrance to the room in question. The central air cooler (thermo tank) has its own regulating station combined with a thawing-off device operated by reversing the flow of the superheated ammonia gases. The supply of ammonia to the ice-making plant is also controlled by a valve fitted near the tank.

The distributing piping shown in Fig. 4 begins at the central station in the compressor room. Each group of cold cupboards is served by a common delivery pipe ; the return flow, however, is through separate pipes, so that the distribution can be controlled by means of the thermometers fitted at their connection to the central return-flow collector in the compressor room.

A brine tank located on the brine cooler is intended to take the whole brine content of the cold cupboard piping and cooling coils when overhauling and repairing the apparatus connected to the piping. This tank is combined with a vessel for dissolving calcium chloride, which is connected to the main brine piping through relief gear. By means of this, it is possible at any time to replenish the brine charge and to keep it up to the desired strength.

The ice tank installed on board the *m.s. Johan van Oldenbarnevelt* is particularly interesting because the shipowners specified that the handling of the ice cans must be absolutely mechanical, both when being filled and emptied. The cans are assembled in frames just as in an ice factory. A hand winch, which can be held stopped at any desired place by means of a rack running along the track, serves for emptying the ice cans. A toothed gear, meshing with the rack, can be stopped by means of a brake, the blocks of which are operated by a spring. By freeing the brake, the winch is free to move further. The ice cans are filled in rows, a frame at a time ; an automatic device ensures that they are filled uniformly to the same depth. The cans are also emptied row by row, a frame at a time, the ice being loosened from them by warm water taken from the cooling-water system of the Diesel engines.

The *m.s. Johan van Oldenbarnevelt* was put in service in April 1930; according to a report meanwhile received from the owners, the refrigerating plant is working faultlessly in every respect.